THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXVII. No. 1719.] LONDON, APRIL 21, 1896. [48TH YEAR. PRICE 6d.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY,

Strongly recommended where EXCESSIVE HEATS have to be maintained.

Lanemark Coal Co., LIMITED.

LANEMARK CANNEL AND GAS COALS.

Quotations and Analysis on Application to

LANEMARK COLLIERY, NEW CUMNOCK, N.B.

Shipping Ports: All the principal Scotch Ports.

— ESTABLISHED 1830. —

PARKER & LESTER,

Manufacturers & Contractors.

THE ONLY MAKERS OF

PATENT ANTIMONY PAINT, Parker's Imperial Black Varnish,

Oxide Paints, Oils, and General Stores for Gas and Water Works.

WORKS:

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And at Pharos Works, Hackney Wick.

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Specially distil Carburine Spirit, specific gravity ·680, or of any other grade suitable for Enriching Gas; also Gas Oil best adapted for injecting into the Retorts, as in the Herring Process.

Importers of Petroleum for Carburetting Water Gas, or for Manufacturing Oil Gas. Distillers of Pentane, Petroleum Ether, and Naphtha for clearing the pipes of Naphthaline, &c.

Samples and Prices may be had on application.

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Gas EXHAUSTER & GOVERNOR.

ABSOLUTELY AUTOMATIC.

REQUIRES NO ATTENTION WHATEVER.

Guaranteed perfectly steady Gauge, no matter how Steam Pressure may vary.

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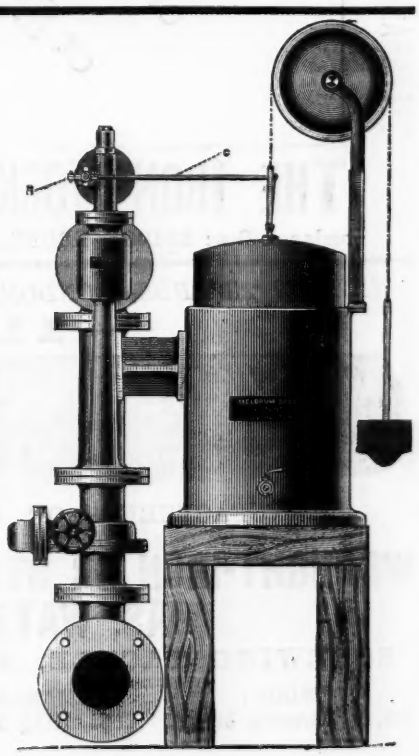

MELDRUM BROS., Atlantic Works, City Road, MANCHESTER.

Telegrams: "MELDRUM, MANCHESTER." National Telephone: No. 1674.

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(ESTABLISHED 1765),

MANUFACTURER OF TELESCOPIC AND SINGLE GASHOLDERS,

WROUGHT AND CAST IRON TANKS FOR DITTO,

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, and all kinds of GAS APPARATUS,

Wrought-Iron Roofs, Bridges, Girders, &c.,

Steam, Hot Water, and Range Boilers, Tanks, Cisterns, Boats, and all kinds of Wrought-Iron Work.

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ENGINEERS & CONTRACTORS FOR GAS-WORKS,

MAKERS OF FISH AND SMITH'S PATENT (NO. 5108) OVERFLOWS FOR REGULATING THE SEAL IN GAS-WASHERS, &c.

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Improved Dry-Faced Centre Valves for Working either One, Two, Three, or Four Purifiers at one time; giving an increase of Purifying Area above that obtainable with ordinary Centre Valves of 33⅓ per Cent.

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WROUGHT-IRON OR STEEL MAINS UP TO 6 FEET DIAMETER, FOR GAS, WATER, OIL, OR OTHER PURPOSES.

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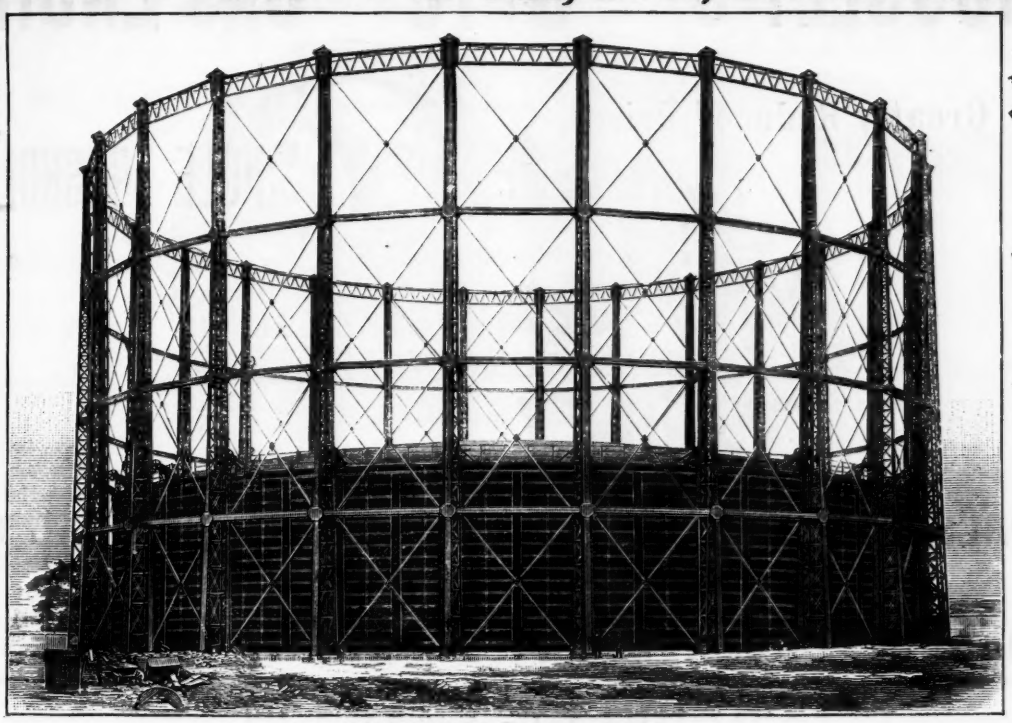

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— HAS ALREADY BEEN SUPPLIED TO GAS-WORKS AT —

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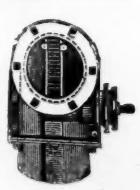

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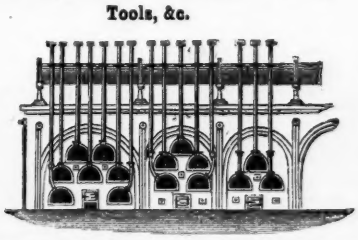

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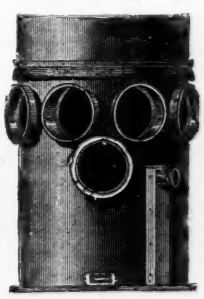
for working Purifiers,

Also Bye-Pass & Stop Valves.



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HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS, and SPECIALS.

WOOD GRIDS.

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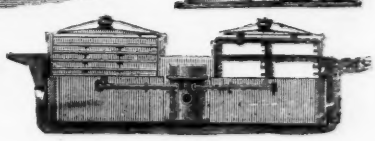

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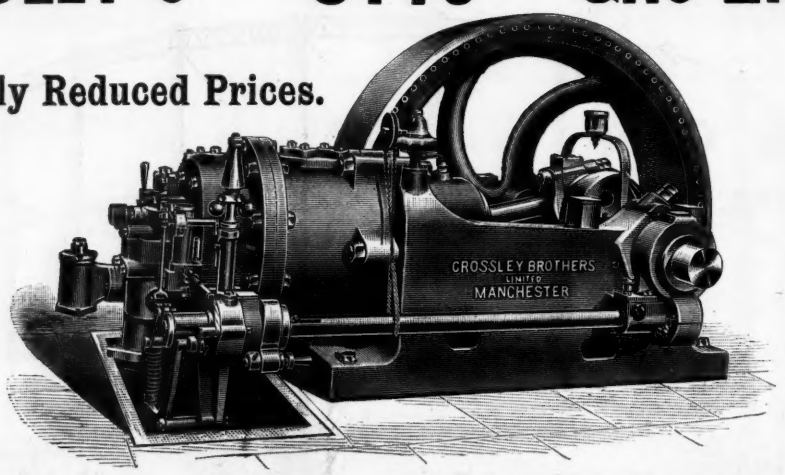
Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

CROSSLEY'S "OTTO" GAS-ENGINES

Greatly Reduced Prices.



REPRESENTS NEW TYPE 40-HORSE POWER NOMINAL HIGH-SPEED ELECTRIC-LIGHT ENGINE.

CROSSLEY BROS., LTD., OPENSHAW, MANCHESTER.

HARRIS & PEARSON,

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FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.

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MANUFACTURERS OF

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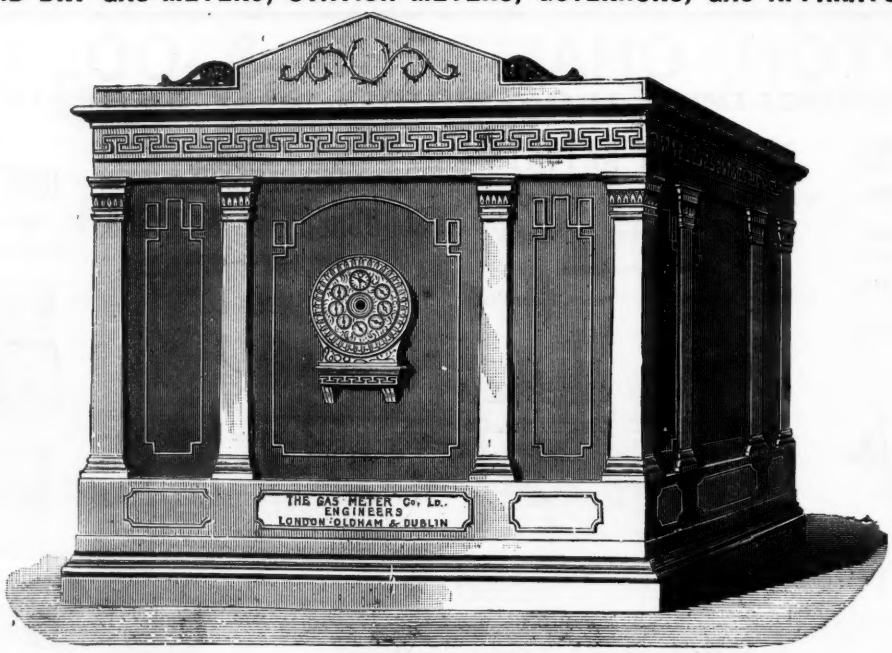

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DESIGN No. 2 PATTERN.

STATION METERS MADE AT THE COMPANY'S WORKS, OLDHAM, LATE WEST & GREGSON. Established 1830.

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Telegraphic Address: "METER."

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INCANDESCENT GAS-LIGHT

(Welsbach Patents).

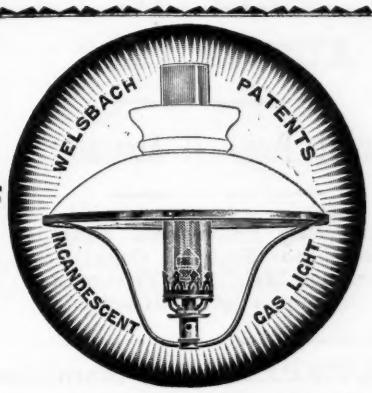
Further Great Reduction in Prices,

FROM MARCH 2, 1896,

Due to Colossal Sales,

Places this highly popular Light within the means of all classes.

The greatly Reduced Consumption of Gas COVERS THE INITIAL COST OF THE BURNERS IN FROM SIX TO EIGHT MONTHS.



The PRICES have been REDUCED as follows:—

The Ordinary "C" Burner to 6s. 6d.

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Prices of other Patterns reduced proportionately.

SPECIAL ATTENTION IS CALLED TO THE

"S" BYE-PASS BURNER, PRICE 7s. 6d.

Which, with a Consumption of 2¼ Cubic Feet of Gas an hour, gives a light of 25 to 30 Candle Power.

This Pattern is particularly recommended where it is desired to effect a large saving in Gas rather than to effect a great increase in the Light.

The attention of Gas Managers and Gas Engineers is called to this System of Lighting as one which tends to Popularize the use of Gas as an Illuminant, owing to the following Advantages—

ECONOMY IN CONSUMPTION OF GAS, COMBINED WITH HIGH ILLUMINATING EFFICIENCY.

FREEDOM FROM SMOKE, DIRT, AND FLICKERING.

GREATLY REDUCED HEAT.

The *Lancet* Special Analytical and Sanitary Commission, in an exhaustive report, pronounces the Incandescent Gas-Light System to be the Healthiest, Best, and most Economical System of Gas Lighting.

SUITABLE FOR EVERY PURPOSE OF INSIDE OR OUTSIDE LIGHTING.

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JAMES MILNE & SON, LTD.,

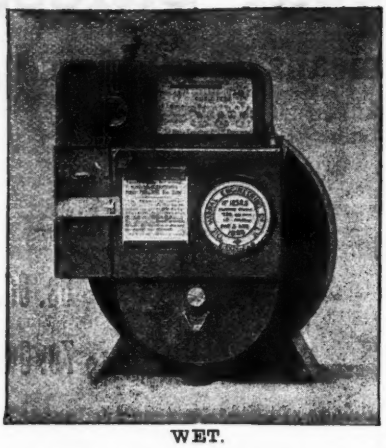
GAS ENGINEERS,

MILTON HOUSE WORKS, EDINBURGH.

LONDON. — GLASGOW. — LEEDS.

THE WIRRAL ENGINEERING COMPANY, LTD.

Patent New Prepayment Meters.



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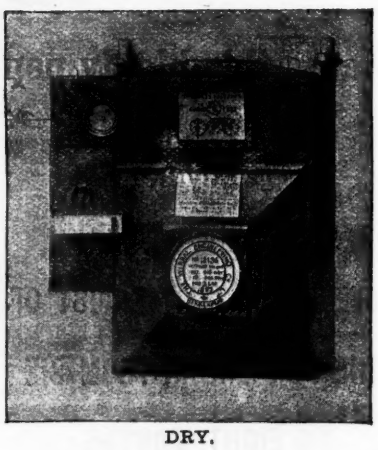
THE "PERFECT" AUTOMATIC.

Simple! Positive!! Accurate!!!

The only Prepayment Meter with no Springs, Counter-Balance Weights, or Frictional Gearing to get out of order.



DRY.

Particulars on Application to the COMPANY, 76, Hamilton Street, BIRKENHEAD.

Some of the Gas-Works and Local Authorities using Crosbie's Manufactures.

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Abergavenny	Clitheroe
Airedale	Cobham
Aldridge	Coleshill
Antrim	Colombo
Armagh	Collingham
Ascot	Colney Hatch
Aylsham	Coventry
Ballymena	Cranbrook
Beaumaris	Cullen
Bentham	Deddington
Bewdley	Dewsbury
Bideford	Downpatrick
Birmingham	Dursley
Blackburn	East Ardsley
Bognor	Eastbourne
Bollington	Elland
Boreham	Ellesmere
Bramham	Elstree
Brandon	Eye
Bridgnorth	Farnham
Broadgreen	Felixstowe
Broadstairs	Garston
Bromsgrove	Gillingham
Broughty Ferry	Gorey
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PAINTS FOR GAS-WORKS.

PAINTS FOR GASHOLDERS.

Contractors to Her Majesty's Government, the Indian Government, the Natal Government, the Turkish Government, the Netherlands Railway, the London County Council, &c., &c.

CROSBIE'S PAINTS.

Guaranteed genuine and free from adulteration, and specially made to withstand Gaseous Fumes.

Catalogue and Testimonials on Application.

ADOLPHE CROSBIE, LTD.,

COLOUR WORKS, WOLVERHAMPTON.

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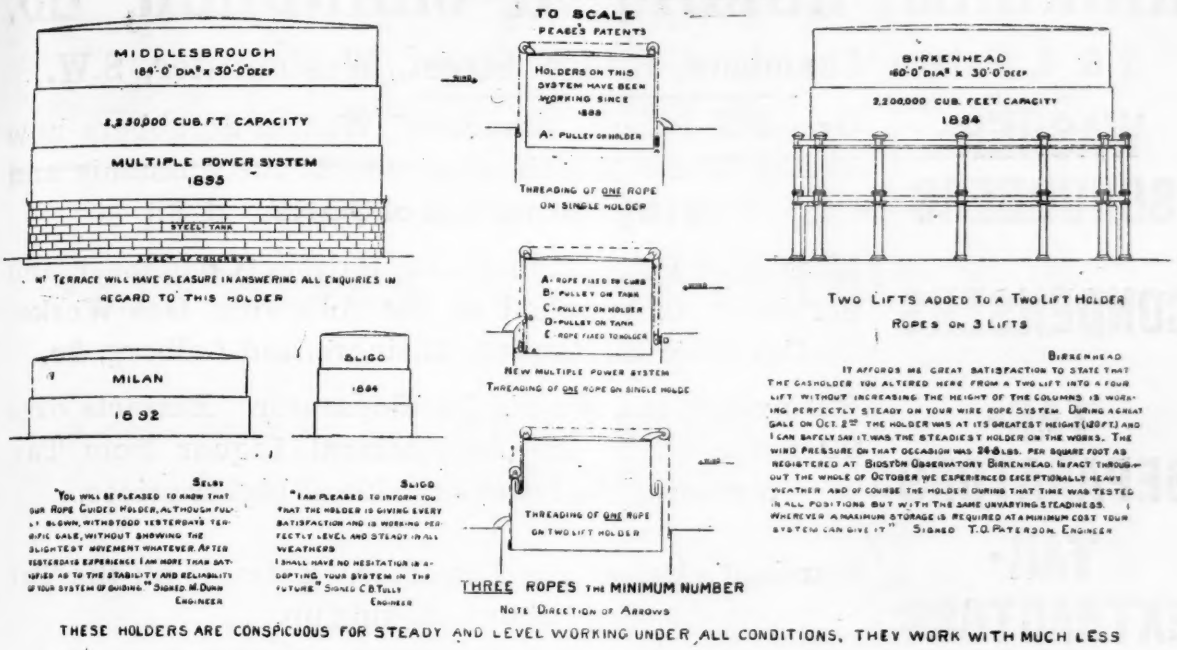
Ilkeston	Rugeley
Irthlingboro'	Scarborough
Johannesburg	Seaham Harbour
Kegworth	Seisdon
Kilrush	Shifnal
Kildwick	Shipston-on-Stour
Kirkburton	Sidmouth
Knutsford	Skibbereen
Leamington	Slough
Ledbury	Southam
Leek	Southend
Leven, N.B.	Stafford
Limerick	Stamford
London	Strood
Loughborough	Stroud
Lymington	Swinton
Merthyr Tydfil	Sudbury
Milborne Port	Tetbury
North Middlesex	Tokio
Outlane	Uppingham
Pembroke	Uttoxeter
Penmaenmawr	Ventnor
Portadown	Warwick
Port Elizabeth	Wexford
Portrush	Wigston
Portsmouth	Willenhall
Pwllheli	Witney
Ramsey	Wollaston
Raunds	Wolverhampton
Richmond	Workington

DIAGRAMS ILLUSTRATING REPRESENTATIVE ROPE GASHOLDERS



Mr TERRACE WILL HAVE PLEASURE IN ANSWERING ALL ENQUIRIES IN REGARD TO THIS HOLDER

SELBY

"YOU WILL BE PLEASED TO KNOW THAT OUR ROPE GUIDED HOLDER, ALTHOUGH FULLY BLOWN, WITHSTOOD YESTERDAYS TEMPESTUOUS GALE, WITHOUT SHEWING THE SLIGHTEST MOVEMENT WHATEVER. AFTER YESTERDAYS EXPERIENCE I AM MORE THAN SATISFIED AS TO THE STABILITY AND RELIABILITY OF YOUR SYSTEM OF GUIDING." SIGNED M. DUNN ENGINEER

SLIGO

"I AM PLEASED TO INFORM YOU THAT THE HOLDER IS GIVING EVERY SATISFACTION AND IS WORKING PERFECTLY LEVEL AND STEADY IN ALL WEATHERS. I SHALL HAVE NO HESITATION IN ADOPTING YOUR SYSTEM IN THE FUTURE." SIGNED C.B. TULLY ENGINEER

BIRKENHEAD

IT AFFORDS ME GREAT SATISFACTION TO STATE THAT THE GASHOLDER YOU ALTERED HERE FROM A TWO LIFT INTO A FOUR LIFT WITHOUT INCREASING THE HEIGHT OF THE COLUMNS IS WORKING PERFECTLY STEADY ON YOUR WIRE ROPE SYSTEM. DURING A GREAT GALE ON OCT. 2^D THE HOLDER WAS AT ITS GREATEST HEIGHT (180 FT.) AND I CAN SAFELY SAY IT WAS THE STEADIEST HOLDER ON THE WORKS. THE WIND PRESSURE ON THAT OCCASION WAS 24 LBS. PER SQUARE FOOT AS REGISTERED AT BIDSTON OBSERVATORY. BIRKENHEAD. IN FACT THROUGHOUT THE WHOLE OF OCTOBER WE EXPERIENCED EXCEPTIONALLY HEAVY WEATHER AND OF COURSE THE HOLDER DURING THAT TIME WAS TESTED IN ALL POSITIONS BUT WITH THE SAME UNVARYING STEADINESS. WHEREVER A MAXIMUM STORAGE IS REQUIRED AT A MINIMUM COST YOUR SYSTEM CAN GIVE IT" SIGNED T.O. PATERSON, ENGINEER

THESE HOLDERS ARE CONSPICUOUS FOR STEADY AND LEVEL WORKING UNDER ALL CONDITIONS, THEY WORK WITH MUCH LESS FRICTION AND IRREGULARITY IN A GALE OF WIND THAN GASHOLDERS WITH COLUMNS, AND ARE ALWAYS STEADY.

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GAS WORKS CONTRACTORS

STOCKTON-ON-TEES

LATEST

Improvements in Sulphate of Ammonia Apparatus

(COLSON'S PATENT)

EXTRACT FROM ENGINEER'S REPORT—

"I can now obtain 60 Tons of Sulphate of Ammonia per week with 'Colson's' Still, using ONE Boiler, whereas, with my former continuous plant, TWO Boilers were required to produce 40 Tons per week."

For Prices and Particulars, apply to the Sole Makers—

ASHMORE, BENSON, PEASE, & CO., LIMITED,

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55 & 56, High Holborn, London.

GAS SERVICE CLEANSERS.

LAMP TORCHES.

DRY GAS-METER MAKERS.

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PRICE LISTS ON APPLICATION.

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WASHER-SCRUBBERS — Over 500 Patent "Standard" Washer-Scrubbers now in use. These Machines extract all the Ammonia and a large proportion of CO_2 and H_2S.

CONDENSERS — Marshall's Patent Combined Battery Condenser and Scrubber, as supplied to the following Gas-Works: Coventry (3), Randers, Elsinore, and Aalborg, &c.

TAR-SEPARATORS — Burmeister and Wain's Tar-Separator. Extracts over 99 per cent. of the Ammoniacal Liquor from Tar, rendering the latter saleable at higher prices.

TAR-EXTRACTORS — Marshall's Patent Tar-Extractor. Extracts all the Tar without choking up.

WATER-SOFTENERS — Bruun's Patent Water-Softener. Prevents all "Scale" in Boilers, increases Life of same, and saves Fuel.

Prices, &c., on application to the above.

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MAXIM PATENT CARBURETTOR

FOR ENRICHING GAS IN BULK.

Over 50 Maxim Patent Carburettors have now been fixed, capable of enriching

650,000,000

CUBIC FEET OF GAS PER DAY.

Among the Companies supplied are The Gaslight and Coke Company, the South Metropolitan Gas Company, Birmingham Corporation, Manchester Corporation, Rochdale Corporation, Bristol Gas Company, and many other Works, both large and small, where they have been working in some instances for the past **FOUR YEARS.**

More Gas and saleable Coke per ton of Coal Carbonized is produced; saving Capital, Labour, Fuel, Wear and Tear, &c.

The Enrichment is **INSTANTANEOUS** and **PERMANENT.**

The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.

SOLE AGENTS FOR REDWOOD & CLOWES' INFLAMMABLE VAPOUR & GAS DETECTORS.

Dealers in Carburine and all other Naphthas for the Enrichment of Gas.

FOR PRICES AND FULL PARTICULARS, APPLY TO

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GASHOLDERS

OF ALL SIZES.

GADD & MASON'S

PATENT

COLUMNLESS SPIRAL-GUIDED GASHOLDERS.

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R. DEMPSTER & SONS, L.D.

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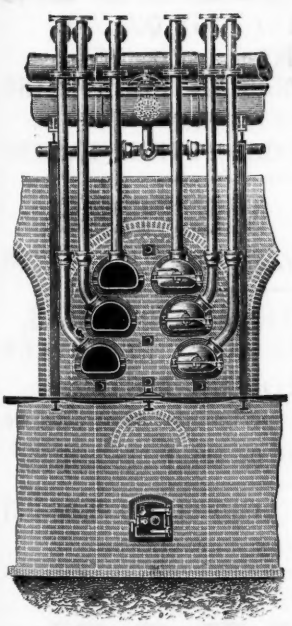
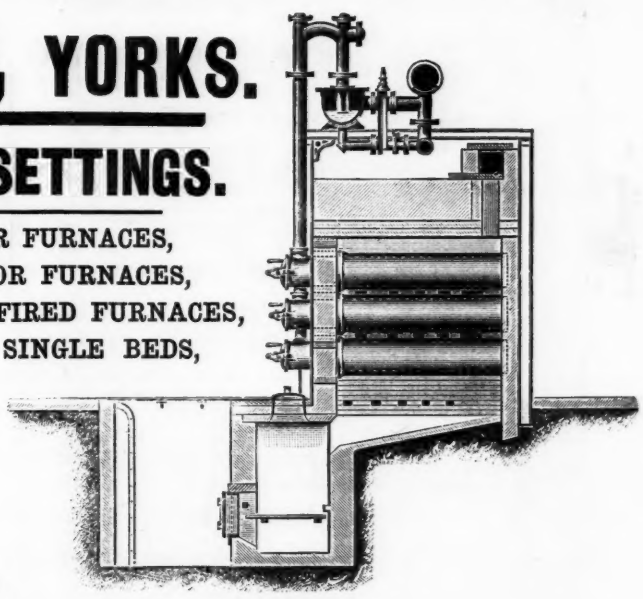


RETORT-SETTINGS.

GENERATOR FURNACES,
REGENERATOR FURNACES,
SIMPLE DIRECT-FIRED FURNACES,
THROUGH & SINGLE BEDS,
SUITABLE FOR

LARGE
OR
SMALL
GAS-WORKS.



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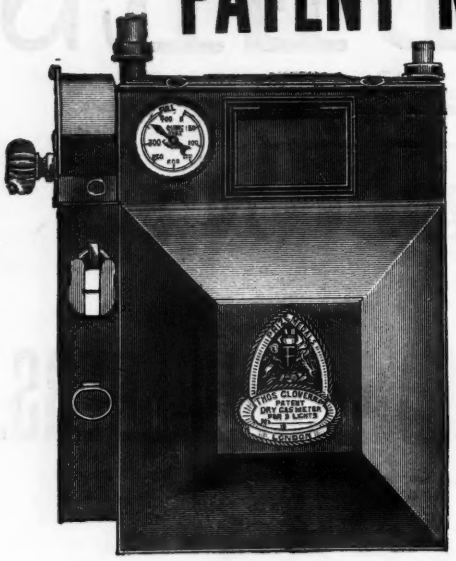
GIVING THE HIGHEST WORKING RESULTS, THE MOST PERFECT HEATING, GREATLY INCREASED DURABILITY, THE LOWEST FUEL CONSUMPTION.

PLANS AND ESTIMATES ON APPLICATION.

THOMAS GLOVER & CO.'S PATENT NEW IMPROVED PREPAYMENT METER



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Simple in Mechanism.
Positive in Results.
Price Changer *in Situ.*

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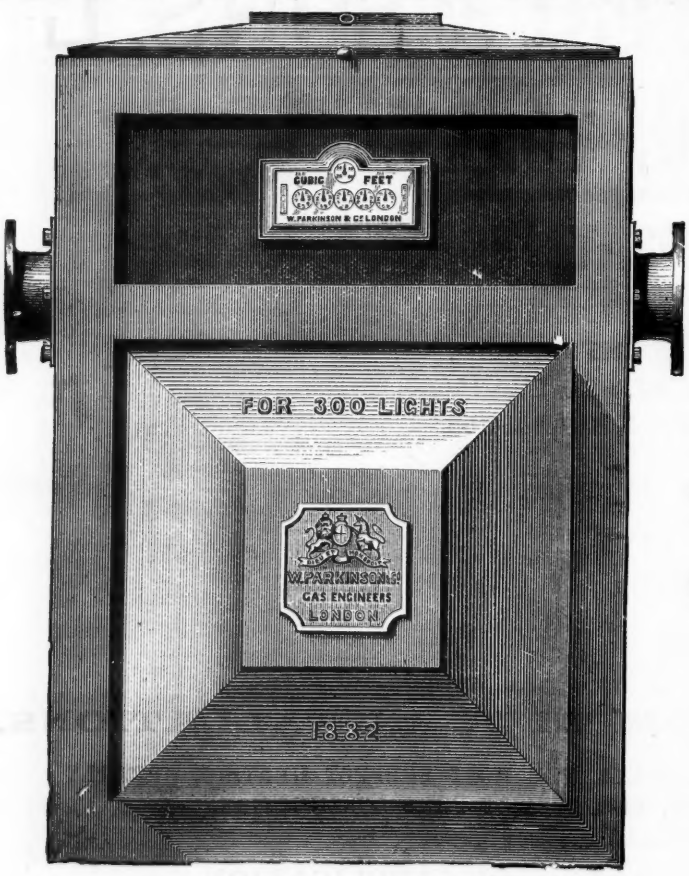

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TO CORRESPONDENTS.

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EDITORIAL NOTES.

The Judgment in the Incandescent Gas-Light Lawsuits.

JUDGMENT was given by Mr. Justice Wills on Saturday in the Incandescent Gas-Light Company's actions against the De Mare and the Sunlight Companies for alleged infringements of the patents of Dr. Auer von Welsbach. Briefly stated, the former defendants lose on all points, with costs (the details of which are to be settled upon further application to the Court); while the particular make of Sunlight mantle upon which this action was fought is declared not to be an infringement of the Welsbach patented mantle of 1885. The judgment, which we report elsewhere in full, is a splendid example of forensic acumen; and most of our readers will accept it, upon the evidence laid before the Court and the manner in which the cases were conducted on both sides, as a righteous one. Inasmuch as the litigation will hardly stop here, but will in all probability—in one instance, if not in both—go to the House of Lords, we cannot treat the issues raised as finally settled; but of the strength and weight of the present judgment it is possible to make full acknowledgment. Seeing the complexity of the scientific points controverted, at extravagant length, before the Court in these cases, it is little short of marvellous that Mr. Justice Wills, sitting as judge and jury, has been able to grasp the real issues so comprehensively, and set them out so clearly in language which is worthy of being described as a model of terse, nervous, pellucid English. It is, happily for the State, usually regarded as superfluous to testify to the high quality of the occupants of Her Majesty's Bench; but performances like this reasoned judgment of Mr. Justice Wills are no every-day transactions even in the Superior Courts of this country. Nothing of importance seems to have escaped the Judge, long and tedious and abstruse as was most of the scientific evidence; nothing trivial or irrelevant seems to have disturbed his judicial mind; and in giving his decision, he did not forget to award praise to those witnesses and Counsel on both sides who had most helped him in the discharge of his most arduous duty.

In condemning the De Mare production as an infringement, the Judge made some severe observations both upon the motives of the defendants and upon the way in which their case was conducted. In allowing that the Dellwik mantle, manufactured according to this inventor's patent specification, is no infringement of the Welsbach 1885 patent, the Judge observed that it gave much less light. So far, therefore, the gain of the Sunlight Company is a hollow victory. What they are pronounced to be free to make under Dellwik's patent—namely, a cheap mantle containing none of the "rare earths"—is of no commercial use to anybody; while the confirmation given by Mr. Justice Wills to the right of the Incandescent Gas-Light Company to the exclusive use of mantles made of the "rare earths" is all that could be desired in the Welsbach interest. It was the hope of the defendants in these cases, as of others behind them, not so much that Dellwik should be held to be no infringer, as that the Welsbach patent should be destroyed, or the rights limited to the use of the substances or the prescriptions set out in the 1885 specification. This hope has so far failed of realization. The Incandescent Gas-Light Company are to be congratulated upon the success of their efforts to protect their valuable patent property. But the public at large, and inventors in particular, have not less reason to rejoice that the Welsbach pioneer patent has so far proved to be maintainable under this most formidable onslaught. Patent laws may or may not be good for the community at large. Opinion is divided upon this question, which it is not our present intention to discuss as an economic problem. The English patent law, likewise, may or may not be the best of the kind in existence anywhere. This also is a general question, upon both sides of which there is a good deal to be said. So long, however, as there is such a thing as patent law, and the English patent law exists in its actual form, it is surely something to be glad of that a well-advised patentee who seeks its protection for a meritorious, epoch-making invention like that of the Welsbach gas-burner should not seek in vain. It is the deplorable fate of many true and original inventors to lose the fruits of their ingenuity through causes beyond

their own control, and also through their having the misfortune of failing to comply with the requirements of the patent law. In the case in point, so far as can be seen, Welsbach failed in nothing. He showed the world how to do something that had never been successfully done before, and was well worth doing. He knew so well what he was about, that his patent specification was properly drawn to include the thing, the whole thing, and nothing but the thing he had in view; and he had his reward. If the present judgment is maintained, he will also be protected against those who would take the same advantage of him that has been attempted of almost every other commercially successful inventor since patent-right was granted as a bar to trade competition in a marketable speciality.

The manner in which the plaintiffs' cases were got up and conducted reflects the highest credit upon all concerned. Mr. Moulton, Q.C., the leading Counsel, abundantly justified his reputation by his speeches and his generalship of the actions throughout. He was well supported at all points. Among the witnesses upon whom the "brunt of the battle," as the Judge himself expressed it, fell, the most conspicuous for ability and candour in the box was Mr. James Swinburne, once best known as among the foremost of the younger order of electrical engineers of the day. Mr. Swinburne received perhaps the highest compliment from the Bench ever bestowed upon an expert witness; and it is a source of satisfaction to know that this brilliant all-round engineer claims a gas engineering training, having, we understand, been once a pupil of Mr. W. J. Warner, of South Shields, before he turned into the seductive, but unprofitable, field of electrical engineering. Mr. Buchanan, as an analytical chemist, also received an encomium from the Judge. Mr. Dugald Clerk, of gas-engine celebrity, rendered good service as a representative of the "competent and intelligent workman" who is as indispensable in the thrashing out of a patent case as the "hypothetical tenant" is in a question of rating. Among the "old guard" of experts engaged in the cases, and mentioned with more or less commendation by the Judge, were Professor Dewar, Sir Henry Roscoe, Professor Crookes, and Dr. Otto Hehner. The actions have been "records" in more than one sense, and to more than a single purpose. The labour involved in them was enormous; the strain of the hearing upon all concerned was most severe; and, in view of the gravity of the interests involved, the cost of the campaign was not counted on either side.

The Meeting of the Institution of Gas Engineers.

By the kindness of Mr. Thos. Cole, the Secretary, we learn that the arrangements for the meeting of the Incorporated Institution of Gas Engineers in London, on the 13th and 14th prox., are in a forward state, and that, so far as the programme of the proceedings can assure the result, the occasion will be full of interest. Mr. W. Foulis, of Glasgow, the President of the Institution, will take the chair, and the business meetings will be held in the new building of the Institution of Civil Engineers, in Great George Street. The annual dinner will take place at the Holborn Restaurant on the evening of Wednesday, the 13th; and on the Friday there will be an excursion to Hastings, to inspect the gas-works, which are under the management of Mr. C. E. Botley, Assoc.M.Inst.C.E. A luncheon, to be given by the Directors of the Hastings and St. Leonards Gas Company, followed by a drive along the sea-front and through the country in the neighbourhood, will pleasantly conclude the proceedings. Six papers have been accepted for reading at the meeting. Mr. George Livesey will contribute one of them, entitled "Gas: Its "Measurement in Relation to Temperature—a Question "for Consideration." Cognate with this will be a paper by Mr. W. Fiddes, of Bristol, on "The Application of the "Expansion of Fluids to the Correct Measurement of Gas," which will introduce to the notice of members a most ingenious appliance designed by the author. Mr. A. F. Browne, the Engineer of the Rotherhithe works of the South Metropolitan Gas Company, will read a paper on "Coal Gas Enrichment," which should give rise to an important discussion on the general question of the expediency of carburetting common coal gas. Mr. Charles Hunt, of Birmingham, has promised some "Notes on "Residuals," which is another highly debateable subject. Mr. Lewis T. Wright will read a paper on "The Efficiency "of the London Argand, at Different Rates of Gas "Consumption, with Special Reference to its Use as a "Gas-Testing Burner;" and Professor Vivian B. Lewes will discourse, with experiments, on the "burning topic" of "Incandescent Gas Lighting." These memoirs, with the delivery of the presidential address, will provide ample occupation for the members during the two days of the meeting, the names of the contributors being a sufficient guarantee that the subjects will be worthily treated. The order in which the papers will be taken is not yet fixed; but, as will be seen by the titles, they fall naturally into distinct groups, as will in all probability be recognized at the proper time. It only remains to wish the President and Council good attendances and pointed discussions, for which those members who desire the good of the Institution cannot do better than prepare themselves beforehand.

Directors in the House of Commons.

Much of the attraction of parliamentary proceedings in this country lies in their picturesque irregularity. Untrammelled as it is in many respects by the hard-and-fast rules of routine, the House of Commons, for all its Draconian Standing Orders and the unwritten laws for its internal regulation, to which those of the Medes and Persians were flexibility itself, can never be depended upon, from one sitting to another, to stick to the business upon the order-paper. One never knows but that in the course of the "Questions," or at some other usually uneventful stage of the day's proceedings, something may turn up to start the whole House off upon a debate as interesting as unpremeditated, and perhaps fraught with as much real importance to the public as any formal motion made at the instigation of the Government or the official opposition. This is what actually happened last Tuesday morning, when a mere accident precipitated a promising movement on the part of the Government with the object of obtaining a clearer settlement of the question of the right of members to vote upon matters in which, as directors or shareholders of companies, they may be said to have some pecuniary interest. The affair arose out of the action of Sir W. Houldsworth, who, as a Director of the London and North-Western Railway Company, had the piloting through the House of one of the Company's Bills. After a debate on the second reading of this measure, Sir W. Houldsworth moved the closure, which was accepted by the Speaker; and the main question was accordingly put forthwith, and carried. Thereupon this member's vote was challenged, on the ground that he had "a direct personal "and pecuniary interest in the Bill." In the course of the debate that followed, the whole subject was very fairly discussed from different points of view. Many speakers seemed to regard directors in Parliament as being very much out of place; and it is obvious that when a Member of Parliament who is also a Director of a public Company undertakes to pilot the Bills of his Company, or to block those of an opposition Company, his action is not that of a disinterested legislator. On the other hand, it was observed, with very considerable force and point, that it is practically impossible to draw the line between legitimate and illegitimate interest in such proceedings. If the votes of members upon certain motions are to be disallowed on the score of their being directors of interested companies, it will be impossible to treat shareholders differently. But if a Member of Parliament who happens to hold a few shares in a railway, or in a gas or water company, is presumed on this account to have a direct pecuniary and personal interest in all proposed legislation affecting such company, in ever so slight a degree, why allow other members to vote upon questions in which their personal interest may not be limited by the Joint-Stock Companies' Acts? Mr. Balfour asked, "was a "member who was either a mortgagee or an owner of land "never to give a vote on anything touching land? Was a "solicitor never to give a vote on any subject by which the "interests of the great body of solicitors might be affected "directly or indirectly?" As "The Times" also put it more particularly, the subject is rather a large one. "It "is the magnitude of the personal interest to which we "must look rather than the precise manner in which it "accrues. . . . Ought a Labour member, drawing his "income from Trade Unions, to be allowed to vote on "labour legislation when his livelihood depends upon the "amount of influence he can exert in a given direction?

"Ought lawyers to have any voice in legislation affecting "the emoluments of the profession; and ought not medical "men to walk out of the House when their interests are "involved in the measure that is under discussion?" The practical and common-sense view of the matter is that the whole question is one of degree. It will be interesting to note the conclusion that the Committee to be appointed to inquire into the subject will be able to arrive at; though nothing that can be determined in this way will apply to municipal corporations and local authorities, who are as acutely troubled in this respect as the House of Commons itself.

An Official Memorandum on the Truck Acts.

THERE has just been issued a Blue Book relating to the working of the Truck Acts. It is entitled, "Memorandum "on the Law Relating to Truck," and contains a mass of information in connection with the general subject, with appendices of statutes and decided cases. It was drawn up by the direction of the Secretary of State for the Home Department; but while it is put forward as a fairly correct statement of the law and its applications, it is admitted that the subject is of considerable difficulty; and this publication is not to be taken as necessarily representing the settled opinions of the Secretary of State or of his advisers. It is an interesting feature of the Acts relating to truck that they are among the oldest that have been passed with respect to the regulation of labour. They date from the fifteenth century. Until 1831, such Acts were invariably directed against the part payment of wages in goods; but in this year all prior Acts were repealed, and a new Truck Act was passed, which has given rise to no small amount of difficulty as to its construction. No very detailed report appears to exist as to the discussion which took place in Parliament respecting this Act. But it is significant, as an indication that even the unreformed House of Commons was perfectly amenable to public opinion, that Mr. Hume denounced the Act as being a yielding to "senseless clamour;" while Colonel Torrens said that, as the working classes desired it, he would support it, though he thought it opposed to strict principles. The suspicion has grown of late that, although doubtless well-intentioned, the influence of the Act has not been wholly beneficial to the classes whom it was meant to protect from an ancient form of abuse. It has had the effect, among others, of concentrating the workman's attention too exclusively upon the amount of his wages as expressed, according to law, exclusively in coin, and has put an obstacle in the way of various movements which in other countries have redounded to the benefit of the working classes. The definition of the word "wages" in the Act of 1831 has given rise to much difficulty, and is considered in this "Memorandum" as effecting a separation between the economic and the legal meaning of the term. A distinction is drawn between what is given as wages—that is to say, as reward for work—and what may be provided to enable the workman to do his work. It is admitted, however, that in practice the line of demarcation is not easy to draw. On the other hand, deductions from wages by way of punishment or of compensation to the employer for bad work, do not come under the Truck Acts. Similarly, non-payment of wages or of any part of wages accrued is not penalized by the Acts, which only provide against an illegal mode of payment. An odd bit of etymological information crops up in this "Memorandum," relating to the origin of the term "Sloper," lately applied to inclined gas-retorts. It is stated to have been first heard of in connection with truck as practised in the Welsh coal and iron mines, and signified a man who slipped away with his advance instead of expending it in the employer's shop. The well-known term "pettyfogger" was coined in the truck-ridden nail trade. The present "Memorandum" should be in the hands of all employers of labour, especially those who contemplate doing anything out of the common to help their workpeople to improve their economic position.

The Secretaryship of the Incorporated Gas Institute.—Mr. Walter T. Dunn, the Secretary of the Institution of Junior Engineers, has been appointed as Secretary to the Incorporated Gas Institute, in place of Mr. F. G. Burfield, who, it will be remembered, resigned the appointment some time ago to take up the position of Assistant-Secretary to the Tunbridge Wells Gas Company.

WATER AND SANITARY AFFAIRS.

THE East London Water (Height of Supply) Bill has met with a singular and deserved fate. When the Bill came on for its second reading in the House of Commons last week, Mr. Pickersgill, who had consented, at the request of his Bethnal Green constituents, to back the measure, rose and spoke in favour of its withdrawal. His speech betrayed the fact that the Bill, like Mr. Pickwick in the pound, had "got no friends." It was understood that this was one of the batch of Water Bills which the London County Council had seen fit to promote in the present session of Parliament. Yet, although introduced under these auspices, "not a single member of "the County Council who was also a member of Parlia- "ment was willing to back the Bill." Such was the statement made to the House of Commons by Mr. Pickersgill, who followed it up by expressing his opinion that the House and those members by whom the Bill was backed "had not "been treated with proper respect." Under these circumstances, Mr. Pickersgill resolved to throw the Bill overboard; and after obtaining its rejection by the House, he moved that the order be discharged and the Bill withdrawn, to which the House of course agreed. Thus one more County Council Bill was "killed." Yet Mr. Pickersgill talked as if it was a very good Bill and a very necessary Bill, and one that ought to be carried. We may presume that the County Council thought so too; otherwise, why did they frame and promote it? But how was it they so failed to obtain for this unlucky measure the support of any one of their parliamentary members? If East London was in the desperate need described by Mr. Pickersgill, how did it come to pass that the County Council thus heartlessly deserted the unfortunate sufferers? Surely the Council could have managed better than this, had they been so disposed? If, indeed, their whole Parliamentary Committee was against them, how is that to be accounted for? We look to the oracles. "London" gives us no light. The "Daily Chronicle" says, concerning the measure: "It was perfectly understood that the Government and the "majority of the House would oppose it." To this it is added: "And so the Bill was lost." But why "so"? Was there no defect in the Bill itself, seeing that Parliament and the Government were against it, and the Council could not find a member in their own ranks to back it? Mr. Pickersgill did his best. He abandoned the Bill; but he attacked the Company. Yet this was simply raising a dust to cover a retreat. There was one remark in his speech which appears significant. It ran thus: "The House, by its recent action, "had indefinitely postponed the purchase policy"—that is to say, purchase by the County Council. If the Council are not to have the supply, what care they whether the water goes 70 feet or only 40 feet above the pavement? Mr. Pickersgill—perhaps in his simplicity—said "there "was a fair and open field for that policy of regulation to "which a large section of the London County Council "were willing to agree." But "a large section" is not necessarily a majority; and Sir John Lubbock's theory of "control" has not found much favour at Spring Gardens. Regulation is nothing; possession is everything. The "Daily Chronicle," referring to the fate of this particular Bill, remarks: "The water history of London will be a "curious tale, whenever it is written." In this view we concur; and to some extent we also agree with our contemporary that in this history "the proceedings of Tuesday "night on the East London Water Bill will be not the "least curious chapter." The Water Bills of the London County Council are all of them worthy of a conspicuous place in a museum of parliamentary curiosities, should one ever be established. As for the Height of Supply Bill, we have already described its character as the height of absurdity; and the manner of its disappearance from the House of Commons is fairly in accordance with that description. Another chapter, though of small extent, may now be added to the history of the London Water Question, recording the decision of the Local Government Board that they are not prepared to alter the existing regulations as suggested by the County Council, so as to substitute three for two gallons as the maximum amount of water to be used as the flush of a water-closet.

A singularly bungling attempt to deal with the Metropolitan Water Question was made at a conference of

Vestry delegates held at the St. Marylebone Vestry Offices last Tuesday. After some rather conflicting motions and amendments had been discussed, a resolution was adopted declaring that to bring sea water to London was itself something to be desired. It was considered that sea water could be used for flushing the drains, watering the roads, and various sanitary purposes, whereby the use of potable water could be so limited as to render any costly scheme, like that proposed by the London County Council, unnecessary. Another resolution agreed to was, that in the event of the present water undertakings not being purchased, an obligation should be imposed upon the Companies to reduce their charges, in regard to any premises where sea water was supplied. It was not explained why the same obligation should not be imposed upon any public authority to whom the present water supply might be transferred. But the whole of this airy superstructure is shattered to pieces by a statement proceeding from Mr. T. W. Grierson, the Engineer to the proposed Sea Water Supply Company, supposing that gentleman to be correctly reported. Mr. Grierson is described as saying that the maximum charge to be inserted in the Company's Bill was five shillings per 1000 gallons. At the same time it was explained that "there was no intention of going so high as that." There is certainly plenty of margin. Perhaps we might reckon on a moiety, and estimate the charge at half-a-crown per 1000 gallons. But how does this compete with the price of water as supplied by the London Companies? The net water-rates as compared with the volume of the supply throughout the eight districts, show that for 1000 gallons of water the consumer has to pay rather less than 7d.! It may seem extravagant to pour filtered water on the roads and down the sewers; and yet, according to a moderate estimate, it would cost four times as much to use sea water for those purposes. That this sea water scheme, if brought into operation, would have any appreciable effect on the economy of the London Water Supply, is a contingency so remote that we pity the delegates who spent their time in considering it.

PERSONAL.

Mr. H. E. Peck, of the Grand Junction Water-Works, has been elected an associate member of the Institution of Civil Engineers.

Mr. W. Ratcliffe has been appointed Gas Analyst to the Bolton Corporation, in succession to Mr. W. H. Collins, whose resignation was recently announced in the "Journal."

Mr. Percy Griffith, Assoc.M.Inst.C.E., M.Inst.M.E., has been appointed by the Gainsborough District Council their Engineer, to complete the extension of the water-works commenced by his partner, the late Mr. Jabez Church.

Mr. Sidney A. Scrivener, who for the past ten years has been associated with his father, the representative of the Wigan Coal and Iron Company, Limited, has been appointed by Messrs. Richmond and Co., Limited, to represent them in the Midland and Eastern Counties, Wales, the Isle of Man, and Ireland.

Mr. Herbert Niven, son of Mr. John Niven, of Clayton, near Bradford, has been appointed Secretary and Manager of the Gomersal Gas Company, in succession to Mr. H. Hawkins, who, as mentioned last week, has gone to Todmorden. Mr. Niven has been for upwards of twelve years with his father, who for the past thirty years has held the position of Secretary and Manager of the Clayton, Allerton, and Thornton Gas Company; and under his care he has received a thoroughly practical training for his profession.

Gas Engineering Society.—On Wednesday, the 8th inst., Mr. C. Tanner, jun., read before this Society (the formation of which was noticed in the "Journal" for Feb. 11 last), at No. 57, City Road, E.C., a paper on "Water Gas." He dealt first with the various petroleums which are used for carburetting water gas both in this country and in America. Having explained the reasons which have for many years prevented the use of this system of gas making in England, he passed on to describe the various types of plant usually employed, diagrams of which were, by the kindness of Professor Lewes, used to illustrate the paper. The two types with which Mr. Tanner had had special experience were the Springer and the Lewes; and of the working of these he gave a full and detailed description, together with an account of some proposed improvements to the former, and the causes of their failure. Then the Lowe plant was described; great stress being laid upon the improvement in the quality of the gas and the saving of fuel effected by making provision for up and down runs. The necessity for superheating the steam and supplying it at high pressure was also duly noticed. After a brief discussion, to which Mr. Tanner replied, a vote of thanks was accorded to him,

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 884.)

The past week has been a remarkable one on the Stock Exchange, if only for the fact that Consols advanced by leaps and bounds, until they closed on Saturday at 112⅛—a figure hitherto altogether unapproached, but which appears likely to be distanced in the near future. At this almost prohibitive price, of course other high-class securities were dragged up too; and almost everything bearing a good character rose in a degree, as those who could not afford the choicest luxuries had to take something else. The cause of all this was the enormous accumulation of money, for which there is no market, coupled with the apprehension prevailing with regard to our African affairs, which limits speculation in the Kaffir market. Naturally, the demand for sound investment stocks made itself felt in the Gas Market; and, though business was not very active, the advance in values was considerable, and it extended to a large number of undertakings. Gaslight issues were buoyant; and the "A" stock, opening at 300, steadily pushed its way up five points higher. A few only of the secured issues were dealt in; and the only change was a smart rise in the 10 per cent. preferences. South Metropolitan had a remarkable week, although not many transactions were marked in them. All three issues advanced; the "A" being promoted no less than 10½, to bring it into line with the "B." Commercials showed a large advance on *ex div.* adjustment; but no business was marked in them. What few transactions were effected in the Surburban and Provincial class showed great strength, and an undiminished tendency to go up in value; and Alliance and Dublin, Brentford, and British advanced their quotations. The general buoyancy in response to demand was well shared by the Continental group; and both Union and Imperial improved freely upon their figures of the preceding week. Tuscan also had an upward move. Several of the undertakings in the distant world were favourably affected; Cape Town and San Paulo being conspicuous. The amount of business effected among the Water Companies continued to be very restricted; and the tendency was irregular. New River and West Middlesex and Southwark debentures were higher; but, on the other hand, there was a slight falling back both in East London and Grand Junction.

The daily operations were: Business in Gas was rather sluggish on the opening day; but the tendency was very firm. Continental Union rose 2; Cape Town debenture, 1; and Alliance and San Paulo, ½. There was not much more animation on Tuesday; but everything was strong, while South Metropolitan "A" advanced 3. West Middlesex Water went up 1. Wednesday produced a little more activity; but still transactions were below the average. South Metropolitan "A" rose 5; ditto "B," 2; ditto "C," 3; and Cape Town, ½. Thursday was very buoyant, though not active; and many quotations advanced. Gaslight "A" and Imperial Continental rose 2; Continental Union, 1½; ditto preference, 2; South Metropolitan "A" and "C," 2½; ditto "B," 1; and British, ½. New River Water gained 2. Friday was the busiest day of the week; and the rise proceeded merrily. Gaslight "A" rose 1; ditto "C," "D," and "E," 5; ditto "J," 3; Brentwood new, 2; Imperial Continental, 1½; Continental Union, 1; and Tuscan, ½. Grand Junction Water fell 2. Saturday was quiet, as usual; and the only change was a further rise of 1 in Gaslight "A."

ELECTRIC LIGHTING MEMORANDA.

A Table of Electricity Supply Undertakings—The Alternating and Continuous Supply Systems in London—Provincial Examples—The Trolley-Wire System of Electric Traction for Belfast Tramways.

A further table showing total capital outlay and receipts and expenditure for the year 1895 of statutory electricity supply undertakings in London and the provinces is given as a supplement to the current number of the "Electrician." This table contains particulars relating to nine Metropolitan and twelve Provincial companies, and also to six undertakings of local authorities. The first edition, published on March 13, was less complete; and the information it contained is now reproduced, with the addition of data referring to two Metropolitan and six Provincial companies, and one municipal undertaking. The London companies now added are the Kensington and Knightsbridge, and the Metropolitan Electric Supply Company; while Birmingham, Eastbourne, Dover, Northampton, Scarborough, and Sheffield swell the Provincial companies' list. The only fresh municipal undertaking in the table is that of Brighton. We mention this publication here in order that our readers, who frequently address to us inquiries on the subject, may know where to look for this kind of information; and, while we are about it, we may as well advise those who are interested in the development of the electric supply industries to make a point of regularly consulting the pages of our best electrical contemporaries, which often contain much interesting matter that cannot be reproduced in our own columns.

Of the London electric lighting undertakings now under notice, the most important is the Metropolitan Electric Supply Company, who have expended £675,000 out of their nominal capital

of a million sterling, in establishing a business upon the alternating system. The Company do not care to publish the number of units sold; so that it is impossible to ascertain how the system as they apply it works out upon this basis. Their accounts, however, support the general contention that with this system the mains come much cheaper than the generating plant—the latter category, be it said, including the transformers, which, it appears to us, ought to be comprised with the distributing plant. On the other hand, this Company's generating expenses run very high; being as much as 66·2 per cent. of the year's working costs, and 55·3 per cent. of this was for coal. The Westminster Company—the largest of the continuous-supply companies—compare very favourably with these figures; their generating expenses being only 40·9 per cent. of the whole, and the coal being only 40·8 per cent. of the generating costs. Evidently, the last word has not been said respecting the comparative merits of the two systems. The wear and tear of the alternating system also appears pretty high. The Kensington and Knightsbridge Company have a good district; and their output of units runs into seven figures. Probably the Metropolitan and the City of London Companies, who do not give this information, are in the same category as to output, which would then comprise six Metropolitan and only one Provincial (Liverpool) concern. There is a great drop from these to the next largest class of electricity supply undertakings, at the head of which stands the Chelsea Company in London, and the Brighton, Leeds, and Birmingham undertakings in the provinces. The Kensington Company have a capital outlay of £206,752, which works out to 3·36s. per unit sold last year; and their mains cost nearly as much as their generating plant. This is due to the continuous-supply system. Their year's revenue amounted to £29,327, and their generating expenses were 1·57d. per unit sold. Thus they are among the most economically working Metropolitan concerns. They paid only 0·68d. per unit for coal.

Birmingham, somewhat curiously, does not use much more than one-half of the electricity that is required for Brighton. Most of the Provincial undertakings have a heavy outlay for mains. The cost of generating and distributing the unit vary very considerably in different places; and the figures relating to these matters suggest several reflections. Brighton, on many accounts, shines as a "bright, particular star" in the table. The capital outlay has been £152,224, which works out to only 3·50s. per unit sold last year—not the absolute lowest in the list (this pride of place being taken by Newcastle, with 2·5s. per unit), but still very low. It is a continuous-supply service, dating from 1891. The total sum received per unit from all sources was 4·85d.; and the generating expenses were 1·46d. per unit. Coal cost 0·72d. per unit, which, having regard to the locality, is remarkably little. The "dreadful example" of this table is Dover. The Dover Electricity Supply Company are young, and up to the present time their business consists chiefly in supplying the public lamps; but, notwithstanding all the circumstances, our contemporary criticizes unfavourably the working of the installation. It is early days, however, to say much about the performance of the Company. In regard to the accounts of municipal electric lighting undertakings, the "Electrician" remarks that "it has been contended that the sums set aside annually by municipalities are the equivalent of the sums set aside by companies for depreciation; . . . but except where an additional sum has been set aside for depreciation pure and simple, a municipality cannot be considered as having adequately provided for depreciation." This is doubtless the correct view of the matter; but it will be anything but grateful in the estimation of those municipalities who are actually making a brave show of electric lighting profits by the simple expedient of ignoring their responsibilities in this regard. For the rest, it would be difficult to find in these accounts any financial justification for the theory that it is expedient for local authorities to go into the electric lighting business.

Electricians are loud in applauding the conclusion of the deputation appointed by the Belfast Corporation to visit and report upon cities and towns where tramways are worked by electric traction, which is strongly in favour of the trolley-wire system, as they saw it in operation in different places, including Bristol in the West and Buda Pesth in the East. This particular deputation travelled far; and it would be interesting to know how their preconceived ideas on the subject, if any, were affected by the observations they made while on their devious way. At any rate, they have now returned to their own handsome and salubrious city fully persuaded that there are no valid objections to be raised to the introduction, with certain stipulations, of the overhead trolley wire into Belfast. There may or may not be anything notable in the undefined reservations which the deputation are still disposed to make in the event of the introduction of the system in question into their city; but it is hard to see why the London County Council and other English local highway authorities are to be blamed for not seeing eye to eye in this matter with the Belfast representatives. Yet the electrical press jeers at the Council because it will not have the trolley-wire system established on the Uxbridge Road; forgetting, perhaps, that it was not wholly a question of this particular thoroughfare, but also of admitting the trolley wire to the Thames Embankment, to which the electricians professed themselves equally unable to see any objection.

MR. WILLIAM WAKE.

We regret to record the death, last Tuesday morning, at his residence, Osgathorpe House, Sheffield, in his 78th year, of Mr. William Wake, the Law Clerk of the Sheffield United Gas Company. Deceased had not been in very good health for some months; but last Sunday week his condition became serious, and he gradually sank. His death severs one more of the few remaining links between the present and the past of the gas industry in this country.

Mr. Wake belonged to a family which for many years has played an important part in Sheffield life. He was a son of Mr. Bernard J. Wake, who occupied a place in the front rank of the solicitors of Sheffield in the early part of the present century. On his death in 1842, Mr. William Wake, who had been brought up to the same profession, carried on the business, in which he was joined by his brother. But the partnership was subsequently dissolved; and Mr. Wake commenced practice on his own account with his two sons. He held the appointments of Registrar of the Sheffield and Chesterfield County Courts; resigning the former in May, 1894, and the latter about two years earlier. Important as was the whole of his professional work, it is that portion of it which was devoted to furthering the interests of the Sheffield United Gas Company—his connection with which extended over more than half a century—that claims notice in these columns. Sixty years ago, the gas supply of Sheffield was divided between two competing Companies. Of one of these Mr. Bernard Wake was the Law Clerk; and in that capacity he helped in 1835 to successfully pilot his Company through a very severe parliamentary contest with their adversaries, and obtain an Act authorizing capital to the extent of £80,000. This contest gave Mr. William Wake, who was then associated with his father in business, his first experience in connection with gas affairs. Competition between the Companies continued till 1844, when they amalgamated; the capital of the two concerns—the United Company, as it was called—being fixed at £135,000. The first meeting of the Company was held in October, 1844; and Mr. William Wake was selected for the secretaryship. They had not been many years at work when they had to encounter the opposition of the Consumers' Company, the Secretary of which was Mr. George Flintoff, who was then a conspicuous figure in the gas world. This undertaking was started in 1852 without statutory powers; and its projectors erected works and broke up the streets, which at times became the battle-ground of pipe-layers. Litigation ensued; and the new-comers had at last (in 1854) to go to Parliament. Of course, their application was vigorously opposed by the United Company, who eventually bought out the Consumers' Company at a discount of about 30 per cent. An Act passed in 1855 confirmed the arrangement. It fixed the capital at £264,984, and contained the unique provision for the appointment by the Corporation of three nominee Directors, an Auditor, and a gas tester. Further trouble arose in 1870, when the Corporation promoted two Bills—one to compel the Company to sell their works at a price to be fixed by arbitration; and the other to enable them to establish competing works if this were not done. Both Bills were rejected without the Company being called upon to say a word on their own behalf. The next year an Improvement Bill was introduced by the Corporation, containing a clause empowering them, whenever they pleased, to go to Parliament, at the expense of the borough fund, to oppose any scheme brought forward by either the Gas or the Water Company. After considerable negotiation, the clause was withdrawn. In the next year came the Borough Funds Bill, which, as originally framed, would have had the same effect as the Improvement Bill. The Company opposed it; and they were successful in getting it so modified that the Corporation could not make any application to Parliament without the consent of the ratepayers. These proceedings necessarily required great acumen and sagacity on the part of the Directors, and especially of their Law Clerk. The services he rendered to the Company, not only during their progress but at all times, were recognized by the shareholders at their meeting in October, 1888, when it was determined to ask Mr. Wake to sit for a portrait to be subscribed for by them, and to be hung in the Board-room. This he did; and the portrait, painted by Professor Herkomer, was on view at the corresponding meeting in the following year. It had been decided in the meantime, however, to present it to Mr. Wake's family, instead of hanging it as originally proposed. The presentation was made by the Chairman of the Company (Sir F. Mappin, Bart., M.P.). Mr. Wake expressed his appreciation of the compliment paid to him, and gave an interesting *résumé* of the history of gas supply in Sheffield, with which he had been so closely associated. Apart from the position he filled with the Sheffield Gas Company, Mr. Wake was the first Secretary and Law Clerk of the Glossop Gas Company—a post he held from the year 1846 down to his death. He leaves a widow and six children. The funeral took place last Friday, at Ecclesfield, in the presence of the personal and professional friends of the deceased; but, in accordance with his wishes, the obsequies were carried out with as much simplicity as possible. The Gas Company were represented by Dr. Sorby and Mr. Fletcher W. Stevenson, M.Inst.C.E.

THE PHILOSOPHY OF POLITICS AND ADMINISTRATION.

(*Concluded from p.* 802.)

THE last of Mr. Lecky's chapters to engage our attention are those in which the author discusses labour questions, in their various modern developments. As a matter of fact, democratic modifications of the existing forms of government, national and municipal, have already progressed so far that "the whole wealth and greatness of the community lie at the mercy of an electorate in which the poorest and least instructed class have the largest share; and, if it is the will, it is well within the power of the democracy to make taxation the most efficient instrument of confiscation." Mr. Lecky describes and criticizes the various Socialistic bodies, more or less popular, that have come into existence of late years, with the avowed object of encouraging all the influences that tend to the suppression of individualism. The Socialists, he observes, "recognized fully that the confiscation of all rent and interest, which was their ultimate object, could only be fully attained in the distant future; but, in the meantime, they worked with all parties who desired to extend the power of the State or of municipalities over industries, to sap in any form the rights of property and the obligation of contract, to throw taxation more and more upon land and realized property."

Mr. Lecky tells how the Socialists managed to obtain a footing in the Trade Unions, and what has come of it. It was the new unions, mainly composed of unskilled labourers, which gave the Socialist demagogues their first lift out of the railway arches and the mud of the parks; and, in return, these extremists converted the New Unionism into a movement of Socialism, and nothing more. Of course, the real objects of these agitators have sometimes, and in some places, to be kept in the background. "One of the immediate objects of the Socialist wing of the Radical party is to advocate on all occasions the absorption of as many great industries as possible by the State or the Municipality, with the curious result that the very men who are preaching the repudiation of debts, and the policy of taxing interest out of existence, are the strenuous advocates of enormous national and municipal loans." The first property to be taken over by the State under this policy, and the largest, would be the railways. "But the railways, though the largest, form only one item of the long list of State acquisitions that are advocated by Socialist leaders, each one of which, in the present condition of society, could only be effected by raising vast loans. Canals, dockyards, tramways, omnibuses, the gas supply, and the water supply are in like manner to be taken over by the municipalities;" and, apparently, as soon as the sovereign democracy should tire of paying the interest on these loans, the obligation would be repudiated. This is an extreme result of the triumph of the New Socialism; but it is Mr. Lecky's merit to show that measures that are far short of it may produce grave evils. Here he comes to the recognition (which does not previously appear) of the truth that it is impossible to throw great burdens of taxation on the rich without injuring the poor, upon whom in the last resort all fiscal burdens fall.

The author observes that "the tendency to place important industries more and more in the hands of municipalities is very evident; and it is not one wholly to be condemned. . . . The municipal government of our provincial towns is one of the most remarkable of English successes; and in several cases great industries which are essential to the town—such as the supply of water or gas—have been taken over by the municipalities, and managed with honesty, efficiency, and economy. At the same time, it must be acknowledged that the low franchise which now prevails is too modern to justify us in speaking with much confidence of its results; and certainly, if the principles and methods of the Socialist party were to prevail in English town government, the evils which have been so abundantly displayed in the United States would not be permanently averted. Municipalities are becoming enormous employers of labour. The labourers are at once their servants and their masters." The author is justified in uttering this caution; for readers of the "JOURNAL" know well enough that the gas-works administration of many municipalities is already tainted with local politics, and that the taint is a spreading one.

The author discourses luminously upon factory legislation and the limitation of the hours of labour, as affecting the interests of the poor, both as workers and consumers. He points out that "in the long run all who are engaged upon an industry must be supported out of its profits; and if an industry is declining, the well-being of those who are employed in it cannot permanently be maintained. Law or combination may compel the capitalist to shorten hours or increase wages; but they cannot compel him to pursue an industry which has ceased to be profitable, nor can they compel the consumer to purchase." The same calm reasoning is employed in criticizing the policy of Trade Unions in other respects.

Mr. Lecky is willing to concede to Trade Unions of the better class much credit, and a distinct place among our industrial arrangements; but he is careful to point out the fallacy of supposing that to these organizations can be attributed the chief part of the large increase of wages which has taken place during the present century. This increase he assigns, like other economic writers, to causes growing out of the production and interchange of wealth. He is not blind, moreover, to the evils of Trade Unionism; and he observes: "That a vast amount of intimidation and coercion prevails in Trade Union politics is incontestable." He seems to entertain the belief, which is nowhere expressed in so many words, but is allowed to appear through his comments upon English strikes and labour disputes, that Trade Unionism would not make so many mistakes if it were not mixed up with Socialism. With regard to strikes, he admits that these outbreaks are essentially of the nature of wars. "They are governed by much the same motives as other wars, and are probably undertaken with neither more nor less wisdom. In some cases they are, perhaps, inevitable. More frequently they are due to false calculations of results, or to false estimates of conditions of trade; and pride and passion, and the personal ambition of individual agitators, enter largely into them." There is more of the same kind of criticism of the ways of democracy in industrial affairs; but we must pass on to give the author's conclusion, which is that "the value of the Trade Unions in representing, sustaining, and extending working men's interests, both at home and abroad, can hardly be exaggerated; but there are great dangers that they may stimulate over-legislation, and largely restrict individual liberty. If they reduce the quality and produce of English labour, by hampering and diminishing the work which each man is allowed to do; if they insist upon the worst workman being paid as much as the best; if they oppose or retard the introduction of labour-saving machines which other countries have adopted; if they so diminish profits and increase risks that capital finds more profitable employment in other countries than in England—if they do these things, they will ultimately prove not a blessing, but a curse, to the working men of England."

The best security of the industrial fabric is to be found in the wide division and diffusion of property, which softens the lines of class demarcation, and gives the great masses of the people a close and evident interest in the security of property, the maintenance of contracts, the credit and well-being of the State. In France, it is the land which attracts the savings of the most thrifty and cautious populace in Europe. In England, the savings of the working classes go into other channels; and every measure which by honest means tends to increase and diffuse these savings in investments is a powerful corrective of Socialist tendencies. Hence, Socialist agitators do not like co-operative enterprises or profit-sharing schemes. Of the latter, Mr. Lecky observes "in general, the Trade Unions dislike them. By establishing a close union between the employer and his workmen, they withdraw the latter from Trade Union influence." Mention is made of the South Metropolitan gas strike as "a desperate but wholly unsuccessful attempt to break down this system." Yet Mr. Lecky thinks there is so much difficulty and complexity in its practical application, that this form of industry is never likely to become universal. He makes a fair point in showing that it can only be successfully practised by large employers of labour.

And now, after having by dint of considerable labour worked through the bulk of Mr. Lecky's book, it only remains for us to repeat our testimony to its value, as a help to the interpretation of the "signs of the times" which are enumerated and discussed in its multitudinous, albeit eminently readable pages. It is no treason to the rule of Democracy to admit that it has its dangers as well as its advantages; and he is the best friend to the democratic State who most clearly distinguishes the nature of these risks, and prepares the public to beware of them.

The Water Supply of Small Towns.—At the meeting of the Society of Engineers on Monday last week, Mr. Percy Griffith, Assoc.M.Inst.C.E., read a paper on "The Water Supply of Small Towns and Rural Districts." The author confined his remarks specially to works supplying a maximum population of 10,000, describing those which he said appeared to him to possess features of interest, or which illustrated the present practice of water-works engineering for small towns and rural districts. The first he referred to was the extension carried out by his late partner (Mr. Jabez Church, M.Inst.C.E.) at Halstead, Essex. The capacity of the plant, he said, was 16,000 gallons per hour, or 384,000 gallons per day. The cost of the works was rather more than £8000, or £1 per head of the population. He described the construction of an impounding reservoir erected at Godalming by Mr. Church; and also the works at Blandford, Dorset, designed by Mr. F. Beasley, M.Inst.C.E., and at Fenny Stratford, designed by Mr. J. Eunson, M.Inst.C.E., both having oil-engines. In the former case, the cost was £1 17s. 6d., and in the latter £1 3s. 4d. per head of the population. Small works were erected at Swanland, near Hull, a purely village supply, the population being only 600, but rapidly increasing, as well as at Sonning-on-Thames—both using oil-engines for pumping purposes. The cost of pumping in the former case was 1·49d. per 1000 gallons lifted 300 feet, not including labour, which represented approximately 1d. in addition; and 1·267d. per 1000 gallons lifted 100 feet, excluding labour, in the latter. An appendix was given showing the expenses, revenue, profit, &c., worked out at per 1000 gallons supplied, together with other data relative to some thirty small water-works undertakings in various parts of England. We hope to notice the paper at greater length in an early number.

NOTES.

The Temperature and Strength of Iron and Steel.

Some elaborate tests to determine anew the effect of temperature on the strength of test pieces of wrought iron and steel have been carried out in the engineering laboratory of Sibley College. In order to make sure of the specimens being thoroughly and uniformly heated, they were enclosed in a block of cast iron, split longitudinally and clamped upon the specimen, which was heated from below by a row of four bunsen gas-burners. Thirty specimens of wrought iron and twenty-five of steel were tested, at temperatures ranging from 22° to 825° Fahr., so as to cover everything which the metals might be ordinarily expected to endure from sun heat or in factory use. Generally speaking, the results of the tests go to show that the curves drawn through the plotted scale of strengths and temperatures have a point of contraflexure at about 70° Fahr., and another at a temperature not far from 400° Fahr. The maximum strength of the materials was found at the temperatures between 400° and 500° Fahr. At higher temperatures than this, all the pieces show rapid diminution of strength. The variation of strength with temperature is well marked. Thus, for example, in the case of wrought iron, if the strength of a specimen at 75° Fahr. is 100, its strength at from 22° to 25° is 103 to 104; at 500°, it is 126; while at 825° deg., the strength falls to 80·7. The curve for tool steel has the same general form as that for iron; but its maximum strength is at 400° Fahr. The minimum elongation of the test pieces occurred when they were broken at about the temperature of boiling water.

The Permanence of Electrical Plant Types.

Writing in the "American Machinist" upon the subject of the present development and future possibilities of electricity, Mr. W. Baxter takes a very sensible view of the matter, and predicts that in the applications of electricity, or in the conversion of mechanical power into the form of energy which we call electricity, nothing revolutionary is to be expected. As regards the telegraph and telephone, this writer holds that any possible improvements in these branches will be of far more interest to the controlling authorities than to the general public. He also argues that the present methods in use for electric lighting and power are "here to stay," and that, although inventors may be able to produce electrical appliances which will enable them to go into the general market and compete on a more or less favourable footing with existing machines and appliances, these latter are not in the least likely to be superseded. Mr. Baxter considers that there would have been more money invested in electrical industries by this time but for the existence of a fear lest what is valuable now may at any time deteriorate in value, or even be rendered worthless by some new, great, and revolutionary invention or discovery. The root of this fear is found in the current notion that the science of electricity is yet "in its infancy," as the popular phrase goes, and that there remains a larger residuum to be learned than is actually known about it. This habit of regarding electricity is also encouraged by the willingness of men of science to confess that they do not know what electricity is; but Mr. Baxter points out that this confession is not true only of electricity. In the same way, we do not know what gravity is, or matter, or heat, or light. We have theories and useful working hypotheses of these things; but no knowledge of realities. The knowledge of the nature of electricity is therefore no more infantile than is our knowledge of the nature of heat, light, and gravity. Mr. Baxter further points out, for the comfort of timid investors, in how small a degree some new devices have superseded old ones in the past.

Mechanical Coal Trimming.

At a recent meeting of the Institution of Junior Engineers, Mr. Chas. H. Fletcher read a paper on the subject of labour-saving appliances for handling coal and ashes in connection with steam generation. The author observed that up to the present time the expense of handling coals and ashes had not been much regarded; but the modern improvements in boilers and engines, by showing the real sources of expense in steam raising, have directed attention to the disproportionate cost in many instances of mere trimming. All of Mr. Fletcher's examples were taken from American practice; the high cost of labour in the cities of the United States having forced upon the managers of water-works and other power stations the question of the expediency of developing mechanical coal handling and stoking. It is probable, however, that a survey of some recent electric power, gas, and water-works extensions in the United Kingdom will supply some unsurpassed examples of the adaptation of machinery to the handling of coal, from its arrival at the works in ships, barges, or railway trucks, to the discharge of the solid residue, in the form of coke or ashes. In many cases, mechanical engineers, in advocating the universal adoption of mechanical substitutes for hand labour in such work as unloading, stacking, or handling coal and coke for any purpose, have a habit of stigmatizing as backward, or indifferent to economy, those who do not unreservedly accept all their conclusions in this regard. There is such a thing, however, as mechanical pedantry; and every problem of the kind under notice should be solved with reference to the true potent factors of the case, which may not be exactly alike.

TECHNICAL RECORD.

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

The Fifteenth General Meeting of this Association was held last Wednesday, at East Dereham. Favoured by fine weather, there was a very fair gathering of members, though the town is somewhat inconveniently situated for the majority of them.

The day's proceedings commenced with a visit to the gas-works, which are the property of the District Council. They are under the management of Mr. A. Drage, the President for the year; and, though of course small, they are well ordered and up-to-date. As a matter of interest, it may be mentioned that it is claimed that East Dereham was one of the first towns in the Eastern Counties to introduce gas; the supply having commenced in 1836. In regard to incandescent lighting, this small town is well to the fore. Scattered through the streets, there are between 30 and 40 incandescent lamps; and the ancient and interesting church is illuminated by 70.

After inspecting the gas-works, the members walked to the Freemasons' Hall, where they found liberal provision in the form of luncheon had been made for them by the District Council. The business meeting was held in the same building; and, at the commencement, Mr. C. W. Grimwood (Sudbury), the retiring President, occupied the chair.

An Official Welcome.

Mr. Grimwood, in opening the proceedings, said he had much pleasure in informing the members that Mr. W. T. Gidney, the Chairman of the District Council, was present, and would offer a few words of welcome to the Association.

Mr. Gidney briefly expressed the pleasure he had in welcoming, on behalf of the District Council, the Association to the town; and said they regarded the visit as an honour to their Manager. He added that they considered the town was well lighted and paved; and he thought the incandescent lighting would attract the attention of the members.

Mr. Grimwood heartily thanked Mr. Gidney for his kind words, and also the District Council for the hospitable manner in which they had entertained the Association.

Minutes of Last Meeting.

The Hon. Secretary and Treasurer (Mr. J. H. Troughton, of Newmarket) read the minutes of the meeting held at Wisbech on Sept. 12, 1895; and they were confirmed.

Annual Report and Accounts.

On the motion of Mr. H. Wimhurst (Sleaford), seconded by Mr. Sharman (Wisbech), the report and accounts were adopted. The former gave a general review of the work and pleasure which occupied the members at the two meetings held last year—in the spring at Sudbury, and in the autumn at Wisbech. Referring to the retirement of Mr. Wimhurst from the position of Hon. Secretary and Treasurer, the report said: "The Committee very reluctantly had to accept the resignation of their late Hon. Secretary and Treasurer (Mr. Harry Wimhurst), who had held the office since the Association was formed over seven years ago, and to whose energy and perseverance much of the success and usefulness of the Association is due. With the view of recognizing the many services Mr. Wimhurst has rendered the Association, a Committee has been formed, who have invited subscriptions from the members, in order to present Mr. Wimhurst with a suitable testimonial." The report also mentioned that the year began with a membership of 62; seven additional members were elected in the course of the year; one member had severed his connection with the Association under Rule 17; and five members had resigned—leaving the membership at 63 on Jan. 1 last. The accounts for the year showed that a balance was brought forward of £24 5s. 6d. The subscriptions received during the year amounted to £36 15s.; making a total of £61 0s. 6d. The expenditure was £33 14s. 11d.; leaving a balance in hand of £27 5s. 7d., and a few subscriptions outstanding.

Additions to the Roll.

Mr. Fred. Gibson, of Chelmsford, and Mr. F. W. Jones, of Bingham, were next admitted as members of the Association.

Thanks to the Retiring President.

Mr. Grimwood then vacated the chair, which was taken by the President-Elect.

The President said his first duty was to move a vote of thanks to their retiring President. Mr. Grimwood had done his best to carry out the work of the office during the year; but he (Mr. Drage) wished that the members had tried to help him a little more. They seemed to have got a bit slow in this respect; and he hoped that, during the current year, they would wake up. He also trusted that the increase in the membership would improve.

Mr. Wimhurst having seconded the motion, it was carried with applause.

Mr. Grimwood thanked the members for the kind manner in which they had expressed their approval of what he had done during his occupancy of the chair. His task had not, he said, been a very difficult one, owing to the excellent help he had received from their late Hon. Secretary, and from the Committee and the

members generally. The Association during the year had not gone backward; but he quite agreed with the President that it would be well if they could get more members, and have greater interest shown in the affairs of the Association.

The PRESIDENT then read the following

INAUGURAL ADDRESS.

Gentlemen,—Having elected me your President for the ensuing year, you must first allow me to welcome you to this town of East Dereham—one of the earliest of small towns to adopt gas as an illuminant, having had works erected sixty years ago. I must thank you for the high honour you have conferred upon me in electing me to the presidency of the Eastern Counties Gas Managers' Association. I hope by the end of my term of office you will not regret the step you have taken. At the same time, I must inform you that I am only one; and I cannot work this Association by myself. Perhaps some of you will say that, as the head, I can do a great deal. True. Nevertheless, a head without any body is not of much use for work; and I must therefore call upon that body—namely, yourselves—to assist me in my efforts to make this year a prosperous and successful one. Let us remember the words used by one of our Past-Presidents at the preliminary meeting held at Peterborough seven years and a half ago, that the Association would bring us together to compare notes and exchange ideas. Some managers seem to think their ideas are not worth much; and they hold aloof from associations because they cannot write papers. I would say to such that there must be listeners as well as talkers; and at some time or another an idea may strike them which, when put into another head, will find its mate, and produce something little thought of by either. The Press also think these meetings are dull, as nothing new seems to come from them; but I must ask them to be gentle with us. We are isolated beings; and when our family is united, perhaps we are not thinking of notoriety, but poking our noses into the holes and corners of our fellow-managers' works to see what wrinkle may be picked up for advantageous use at a future time in our own works. I must say another word on these matters, and it is that members must endeavour to make these meetings fruitful; otherwise we shall find outsiders still keeping out, and members will drop off from sheer indolence.

The gas industry, like the chief industry of the counties in which the greater part of the members of this Association reside—viz., agriculture—is suffering from depression in some of its branches. Competition is very strong against the illuminant we supply; and although our hopes were raised a short time back by the increase in the price of petroleum, they are in a fair way of being dashed to the ground again by the fall in prices. As the Great Eastern Railway Company are seeking powers to use the Midland and East Coast Railways to bring coal from Derbyshire and the Midlands, we may be able in the future to purchase coal cheaper, and thus be enabled to supply a cheaper gas. Electricity hems us in very closely on all sides, both for lighting and motive power; and those who have not the sole rights to the lighting business are no doubt now feeling the effects of this competitor. Another illuminant has made its appearance which, when perfected, promises to be our most formidable rival—viz., acetylene. Costing, as stated, a very small sum, and being of a very high illuminating power, we shall find, if these supposed advantages are established, that it will be an enemy not to be despised. The only thing at present in our favour is that a burner has not yet been found to burn acetylene properly, and that its fumes are poisonous, although Professor Lewes denies this.

Sulphate of ammonia seems to be a drug in the market; and therefore ammoniacal liquor is worth little. As we do not all have sulphate plants, the liquor is simply thrown away. The coal market, too, seems to be unsettled again, and the agreements which were made may be expected to be terminated at any date; thus bringing us to the spot we were in three years ago, at the time of the great coal strike. It has been mooted in more than one presidential address that gas companies and managers should take some steps to see if these things cannot be avoided. It is almost time that large consumers of coal, as the manufacturers of gas are, should adopt measures to prevent themselves falling into the same hole they were in at that time. This might be done by boards of conciliation, composed of representatives of the coalowners and the miners; and also by agitators explaining to the miners the evil effects arising from strikes, not only to their own interests, but to many others at a great distance from that centre.

Our brethren in northern parts are trying to keep this wolf from the door by using oil and water gas. Our friend Mr. Pike, of Colchester, seems to be the pioneer of water gas in the Eastern Counties; and we hope at some future meeting to hear of the success he has met with in that line. It will no doubt place us in the position to supply a cheaper material, and so to compete with petroleum. The incandescent burner, too, although some of us do not look upon it with a favourable eye, on account of mantle expenditure, has placed in our hands a most powerful weapon against electricity as applied to lighting. When litigation between the companies ceases, no doubt it will become more common than it is at present.

The slot meter has also given us an opportunity to increase our sales of gas; the consumer paying for the gas as it is used. The custom of quarterly payments has, I think, deterred artizans from adopting gas, because of their inability, or objection, to pay a bill of £1 to £2 at one time. But by putting in a penny (which is sent for oil, if gas is not in the house) the consumer pays as he goes along, and therefore thinks no more of it, and almost always consumes more than he did when paying quarterly. No doubt you say this also increases our stock of tar and liquor. Well, we cannot have everything our own way. We must hope for the best. Perhaps some of us ought to turn farmers, and use our own products, and show, by our example, the effects of these products as manures. I hear some say we are agriculturists, or want to be, for we are often asked questions on that point when people are buying sulphate. Let some try a plot of land, which most of us have in or contiguous to our works, and grow various crops, and show proofs of what it will do as a manure. I think sulphate could be disposed of locally at a higher rate than is given now, although in smaller quantities. You who have sulphate plants do not agree with me in this: but perhaps some among you who have an inclination to dabble in agricultural matters will try this, and give us the benefit of your experience. Pamphlets, we know, are already published on this subject; but farmers in general do not read these pamphlets. But when shown the crops grown, it would be sufficient to convince the most incredulous.

So much for depression. I hope I have not depressed your spirits in speaking of it; and I am sure you will forgive me for allowing my thoughts to run on as they do. We have passed through a winter much less severe than its predecessor, and we must naturally look for a decrease in the sales of gas. Yet in most places an increase has been shown, and not a small one either; so we may congratulate ourselves that our rivals are not overtaking us.

The future for gas seems to be as promising at present as it ever was, as new fields for its use appear to be opening up everywhere. Our brothers-in-arms, the gas-stove and engine manufacturers, are doing their level best to popularize gas; and we managers must certainly try to work hand-in-hand with those gentlemen—not relaxing our efforts one iota, but keeping pegging away at the householders and occupiers in our respective towns to get them to be users of our commodity. Sometimes a little judicious argument with a person will get him to become a consumer of gas. It will be much better when the owners of works see their way clear to fit up houses above a certain rental, and charge the cost in the price of gas. Slot meters enable us to do this; still I think there is much more to be done.

Talking of meters, it would be well if all meters in a town were tested at least every three years. It would surprise some if they did that, as it surprised me when the meters were tested here a few years back, and several were found from 20 to 30 per cent. slow, and in two instances registering 1 foot for 2 feet, or 50 per cent. slow. The leakage account showed at that time 30 to 40 per cent. I do not presume that this was all from meters; but after the testing was done, the leakage account decreased on the first quarter to 14½ per cent., and on the whole year's working to 13 per cent.

Most of us have had an opportunity of seeing the new thing in gasholders—viz., the columnless—our very esteemed friend Mr. Wimhurst having shown us one in actual use at his works. As the cost is much lower than the old style, we shall watch its working with interest, and shall, I hope, have the benefit of his advice when we are contemplating erecting one.

The explosion at Forfar and Mr. Vernon Harcourt's report thereon will, no doubt, lead to something being done in the way of dissolving the tar which gets amalgamated with salts, and forms a hard deposit on the bottom of the hydraulic main, and by that means upsets the seal there. It also brings us to the question of insurance, which was recently mooted in the Press. If the premium is not too heavy, no doubt insurance will be adopted. But insurance companies, I am afraid, consider the business very risky, and will therefore charge high for it.

One subject more before I finish. Our legislators are trying their best to pass a Pure Beer Bill. Perhaps some among you will ask: "What has that to do with us?" No doubt you are dry subjects, and should like pure beer; but what that has to do with gas you cannot see. My opinion is that it has something to do with it. A pure beer can be made with saccharine as one of its constituents; and therefore more saccharine (a product of tar) would be used—thus increasing the price of the tar.

On the motion of Mr. J. BARTON (Peterborough), seconded by the HON. SECRETARY, a hearty vote of thanks was passed to the President for his address.

The PRESIDENT responded; and, referring to the character of the address, he remarked that, as small gas managers, they could not go into the theoretical and chemical sides of gas manufacture, and so they had to confine themselves to the practical part. Proceeding, he said, as a paper could not be obtained for that meeting, their Secretary, at the last minute, had filled up the breach by jotting down a few notes on which to base a discussion.

Mr. TROUGHTON read the paper, which was entitled—

GAS *v.* ELECTRICITY AS AN INVESTMENT FOR TOWNS.

It recently occurred to me, after I had received several disappointing letters from our members declining to read a paper or get up a discussion, that I might give you a few figures

relating to the growth of the Newmarket Gas Company, and its relation to the town as an investment, with the view of raising a discussion. Briefly, I may say that we are threatened with the electric light—first, by a private Company who gave notice to the Board of Trade last October of their intention to apply for a Provisional Order; and, secondly, by the Local Authority, who have decided to oppose the Company, because in years gone by the authority missed acquiring the gas-works and water-works, which have turned out such good investments. Consequently, they made up their minds to apply for a Provisional Order, so as not to miss any more good things; and they will do so, I presume, next autumn. This opposition has, of course, stopped the Company.

In passing, I may say that our Town Surveyor estimates that an electric installation costing £10,000 can be put down in Newmarket, and worked at a profit of £600 a year. That 6 per cent. will be very nice when they have made it; but we hear of so many electric concerns that earn nothing at all, and so few that earn 6 per cent., that we may be excused for being somewhat dubious. I know several large towns which are supplying electricity at a loss.

The point I want to bring before you is that a gas company in a small or medium-sized town, with a growing business, is a better investment to the consumers of gas, who are the ratepayers, than is an installation of electric light, whether it be supplied by a company or by the local authority. We make and sell four times the quantity of gas that we did twenty years ago; and we are selling it at 2s. per 1000 cubic feet less than we were then. I will give you a short statement of the growth—

In 1875–6	we made	11½	millions,	and sold it at	5s. 10d.	per 1000 feet.
,, 1879–80	,,	17¾	,,	,,	5s. 0d.	,,
,, 1883–4	,,	22¼	,,	,,	4s. 6d.	,,
,, 1889–90	,,	36½	,,	,,	4s. 2d.	,,
,, 1894–5	,,	46½	,,	,,	3s. 10d.	,,

This reduction in price is entirely due to the expansion of the Company's business. The difference between 5s. 10d. and 3s. 10d. means that on our last year's sale of gas over £4200 per annum was given back to the consumer by way of a reduced gas bill; and this sum will go on increasing with the Company's business. Besides this, we have paid dividends for several years of 10, 11, and 12 per cent.; and the last dividend was at the rate of 12½ per cent. upon all our capital.

Last year we obtained a Special Act of Parliament, with the sliding-scale and auction clauses inserted, which provides that all new capital shall be sold by auction or tender; and we expect to raise the £15,000 of new capital authorized at about 4 per cent., and the £15,000 of loan capital authorized at 3¼ per cent. We are at present offering £5000 of debenture stock at 3¼ per cent.; and this money will be expended on extensions as the demand arises. You will thus notice that we have power to raise £30,000, which we expect to get at from 3¼ to 3¾ per cent., instead of allotting it among existing shareholders at par as formerly, and paying the usual 10 or 11 per cent. dividend upon it. There is a great saving here; and it affects the consumers of gas very considerably. If this capital is properly laid out on extensions, it should (and I think it will) earn 12 or 13 per cent. After paying the interest on it, 9 per cent. will remain, which on the whole of the new capital will amount to £2700. That will be apportioned under the sliding-scale as follows: 73 per cent., or £1964, of this sum will go annually into the gas consumers' pockets instead of into those of the shareholders as formerly; and only the remaining 27 per cent., or £736, will go to the original proprietors. I think this gives the consumers of gas a large interest in future extensions and developments of the Gas Company, which to a very great extent is carried on for their benefit, so far as future business is concerned; and the consumers are the general public, for, with the aid of the slot meter, we shall soon have every one using gas.

I think a town that has quadrupled its make of gas in twenty years, and reduced the price 2s., may reasonably be expected to double again in fifteen years; and at our present rate of growth we estimate that we shall do so. Assuming that we do, and are selling, in round numbers, 100 million cubic feet (which I do not think is an extravagant estimate), we ought, owing to the growth of the business, the benefit we shall have from cheaper capital, and the economies in production that follow growth, to be selling gas at 2s. 6d. per 1000 cubic feet. This on a sale of 100 million cubic feet would mean the enormous sum of £6666 being returned annually to the consumers of gas in the shape of reduced bills. That is, of course, looking ahead some fifteen years; but I will come nearer home. That large sum of money will be given back to the consumers by degrees; they will not have to wait fifteen years. Supposing we are enabled next year to reduce our selling price by 4d. on a sale of 46 millions, the consumers would get £800 in reduced gas bills. So you see the public have the prospect of getting almost immediately a further reduction of £800 per annum, or more than our Surveyor estimates he can earn from the electric light.

But supposing the electric light comes in and prevents us extending our business as we are doing at present, it may have the effect of keeping the price of gas at its present figure; and instead of the Gas Company giving to the town a reduction equal to £800 per annum, the town itself will be the cause of the loss. But it might go beyond simply keeping the price of gas at its present figure. It might have the effect of causing it to be increased; for a Company selling gas under the sliding-scale may increase their price. Substantial reductions can be made in the price of gas only where there is a growing and increasing business. I do not, however, wish you to infer that there should be no electric light in our towns, because I think there is plenty of room for both illuminants in many. But in our small towns—in the Eastern Counties, for instance—I think figures such as those I have given should be laid before the public before they are "rushed" into a heavy expenditure to supply the electric light. We can all work out these facts as they apply to our own towns; and they should be forced home to the consumers and ratepayers when they are tempted with a glowing electric lighting scheme, for it can generally be proved that they have already a far better source of income in the gas-works than can be offered by electricity. Besides, the electric light may not pay even in the hands of the local authority, but, on the contrary, money be lost, which would have to be made up out of the rates; and the poor ratepayer would have to pay his quota to maintain a light which at present can only be termed a luxury for the well-to-do. Thus the many may have to help to keep the electric light going for the few. I know several of our members have questions relating to this subject before them at the present time; and if they will discuss them, and give us their experience, I shall be glad that I brought the matter before you to-day.

In conclusion, I think that, with such a large interest in the local gas-works as the public undoubtedly have in nearly every town, they should be slow to embark on a new enterprise which, as we all know, so seldom pays its way, and which, on the other hand, may prevent the gas company from conferring such large benefits on the town as I hope I have shown can be, and generally are, conferred, by a growing gas concern, whether it be in the hands of a corporation or a company.

Discussion.

Mr. J. Dixon (North Walsham) remarked that in the town which he represented they were threatened with the electric light. The question had been discussed by the District Council; but in that body they had not one practical member who understood anything about the subject. It was curious to notice how, as soon as this question of electric lighting came before local authorities, the members at once seemed to know all about it. One member on their Council who was a crockery dealer stood up and said that, in his opinion, the electric light was cheaper than gas; but he gave no statistics in support of his statement. Another member—a draper—dilated upon the beauties of the light; and, indeed, from all that was said, it seemed that at North Walsham, they were going to have electricity for nothing. Being a member of the District Council, and the Secretary and Manager of the Gas Company, he made certain inquiries; and, on mentioning the matter to a friend, he told him of Cowpen, where the electric light had been adopted, and had proved a failure. He (Mr. Dixon) wrote to the Chairman of the Blyth and Cowpen Gas Company for some information on the subject; and he replied in this way:—

I must first explain to you that our town is composed of two townships—namely, Blyth and Cowpen—each having a separate District Council. The Blyth Council have never used anything but gas in their district. The Cowpen Council and Gas Company could not come to terms. Hence the adoption of electricity, which was used for six years, and has now been abandoned; the Council having agreed to burn gas on the same terms as Blyth. The reason why electricity has been given up was brought about on account of the great expense of Cowpen lighting, in comparison with Blyth, and also because, while the back streets of Blyth had lamps, the back streets of Cowpen were in darkness. The public dissatisfaction showed itself by the election of new members on the Council, who went in for gas. If you want more information from what would be considered a neutral party, you might apply to the Clerk to the Cowpen Urban Council.

Acting upon this suggestion, he addressed the Clerk of the District Council, who answered as follows:—

The lighting area within the district of the Council was, for a period of six or seven years prior to the 15th of May last, lighted by electricity, but it was an utter failure. The system of lighting was by overhead wires; the lamps being fixed in such a position in the main thoroughfares as was thought would light up the various back streets in the district. This it did not do; and during the whole time the electric lighting was in existence, one half of the district was not lighted at all. The Council have now returned to gas; and for a small district like this, the system of lighting by gas is much cheaper. Prior to returning to gas, the Council invited tenders for the lighting of the district by electricity; and they found that it would cost from £6000 to £8000 to lay down a proper installation. This was found to be so expensive that they eventually decided to return to gas. Taking the whole matter into consideration, I have no hesitation in stating that, for a small town, gas is the cheaper mode of public lighting.

The publication of these letters in the papers circulating in North Walsham gave, said Mr. Dixon, much annoyance to the advocates of electric lighting. When he became Secretary of the Gas Company some ten or twelve years ago, the price of gas was 5s. 5d.; and it had been reduced to 4s. 2d. The system the Company had followed had been to reduce the price as soon as they possibly could after raising the dividend; and they had met the consumers (of whom they had now 150) in every way. For the public lighting they received £140 from the town, including lighting, extinguishing, and cleaning. The argument for the electric light was that, if it was taken up, this £140 would pay for everything. Now in small towns like North Walsham, there was not room for two lighting companies—the

one would spoil the other; and people seemed to overlook the fact that if the consumption of gas increased, the Gas Company could, without any additional labour, supply at a cheaper rate. The price of 4s. 2d. at North Walsham, he thought, would compare with other places of an equal size. He did not know what the charge was at Dereham.

The PRESIDENT: We have two prices—3s. for cooking, and 4s. 6d. for lighting.

Mr. DIXON proceeded to refer to other information he had collected during his investigations, and stated that he could not (with the exception of Thetford) find any place like North Walsham that was supplied with electricity at a cheaper rate than gas.

Mr. E. G. SMITHARD (Kings Lynn), speaking of the "high" dividends electric lighting companies were supposed to be going to make, said he saw in the "JOURNAL OF GAS LIGHTING" that the Belfast Corporation had made a profit of £385 during the past year, not allowing anything for interest or sinking fund, and that the gas-works had provided all that was necessary in that respect. As most of the members were aware, he was formerly at Chelmsford, where they had a little electric lighting. As Mr. Troughton had put it, there was not room in a small town like that (where the Gas Company's make was between 30 and 40 millions) for both electricity and gas. At Chelmsford, it affected their consumption something like 8 millions. They made at one time a maximum of 40 million cubic feet, and now it was 32 millions; the consequence being that the dividends were also affected. They would find it was so in all little places where they were running the two lights together—they would both be affected. He did not think there were any electric lighting works outside London that were paying dividends. As to the comparative prices of gas and electricity, of course everything turned on the cost of the electricity. In the paper read by Mr. Tew at the Belfast meeting of The Gas Institute in 1893, he stated that electricity could not be manufactured for less than 5d. per unit. This figure, light for light, would compare with gas at 4s. 2d. per 1000 cubic feet—taking a unit as being equal to 100 cubic feet.

Mr. DIXON remarked that he inquired of the Incandescent Gas-Light Company as to how to calculate the difference between the cost of gas and electricity; and they put it this way: Take the price of 4s. 2d. at which they were selling gas at North Walsham, the supply of 5 cubic feet per hour for 1000 hours would come to £1; whereas electricity, at 6d. per unit, would work out (roughly speaking) to 30s.

Mr. SMITHARD added, as to the cost of public lighting at Chelmsford, that the Gas Company's tender (which was not accepted) was, he believed, for £650 while last year something like £1000 was paid for lighting by electricity. He was not prepared to say that there was not more lighting; but there was not sufficient to account for the difference. He understood that the tender accepted for electric lighting was for about £850.

Mr. J. BARTON (Peterborough) asked to be allowed to make a few remarks as to street incandescent gas lighting. At the last meeting, he said, they had a little discussion on that subject; and since then he had been making some experiments with the light in clusters of three. As he stated at the previous meeting, up to that time, the lights he had tried had been a failure. He had, however, altered the lamps; and he was pleased to state that he had obtained much better results—he thought he might say they were pretty well perfect. The illumination from the incandescent lamps in the streets was certainly quite as brilliant as the incandescent lighting in the shop windows. This had been accomplished in this way: He had altered the 60-candle power lamps by taking out the glass (or solid) bottom, and substituting a perforated zinc plate; and this seemed to get over the difficulty. The incandescent light, in clusters of three (a single one was the same), required a greater supply of air than an ordinary gas-flame. The 60-candle power lamp consumed (say) 15 cubic feet of gas in the ordinary way, while the 180-candle power incandescent gas-lamp consumed practically 12 cubic feet of gas; but this 12 cubic feet required more air than the 15 feet. As to the cost of electricity compared with gas, he found that an electric lamp giving 10-candle power, compared with gas at 3s. 4d. per 1000 cubic feet, cost ½d. per hour; but an incandescent gas-lamp costing the same gave them 80 candles, or eight times as much light. That was the difference between the cost of electricity as given by electricians and the cost of incandescent street lighting.

Mr. R. J. SHARMAN (Wisbech) said that at the last meeting he rather ridiculed incandescent gas-lamps for street lighting; but since then he had been induced to try the light again. He had had a lamp introduced to his notice that was particularly adapted for the incandescent light; and he had tried one, as the cluster light had proved a failure in the old lamp. He placed it in one of the worst possible positions he could find, where it would catch the wind from all quarters. It was put up in November; but after a fortnight, some misfortune occurred to the mantle, and it went to pieces. A new mantle was fixed; and from the end of November to the previous Sunday night, the lamp had never, to his knowledge, been out or touched. It was blown out on Sunday night; and he himself went to re-light it. It struck him that the lamp was not particularly dirty, though, of course, a cleaning would improve it. He believed the Corporation were now advocating incandescent gas lighting; and the Company were prepared to fix the lights for them if they desired it. But the great point was whether they could adapt the present lamps, or would go in for a special lamp. The lamp he had tried had certainly so far proved a success. As to the electric light, he did not think they, as gas managers, ought particularly to set up their backs against it, seeing that the introduction of the electric light gave them an impetus to improve gas lighting in order to compete with it. He thought there would be room for both systems of lighting. If towns liked to spend their money in electric lighting, let them do so; they would gain experience by paying for it. There was no doubt, when electric lighting was introduced, it woke gas companies up, and put them on their mettle, and had led to a considerable reduction in the price of gas. The first duty of a gas manager was undoubtedly to the shareholders; but, at the same time, he ought to study the consumer, and produce gas at the least possible cost.

Mr. R. G. SHADBOLT (Grantham) drew attention to the fact that the discussion had departed from the topic introduced by Mr. Troughton, which was something to this effect: Is electric lighting an equally good investment to gas? So far as he could see, he did not think it was. But gas managers were interested parties; and people did not take much notice of what they had to say on this subject. The only time at which they could object at all was when the local authority proposed to spend an amount of money as they would think wastefully; and then they could protest as large ratepayers. With this exception, he thought the best thing for them to do was to give electricity a fair field and no favour, and to meet it with truthful statements. He, as a gas engineer, could not help complaining of the untruthful statements electricians disseminated—it might be from over-enthusiasm, or indiscretion, or it might be that they did not understand the subject thoroughly. (Laughter.) He thought the attention of electricians and that of the public ought to be drawn to this. He knew of cases where the public were actually gulled simply because they did not understand the subject. As to the adaptability of incandescent gas-lights for street purposes, he might say that they had been experimenting with them at Grantham during the past winter. They had been guilty of not altogether adhering to the Welsbach lights; and they had tried a variety of kinds—whether rightly or wrongly remained to be seen. They put up about thirty burners, in groups of four, three, one double, and the remainder single; and, in each case, they took the lamp-heads as they found them. His experience differed somewhat from that of Mr. Barton. Instead of increasing the air supply, they had to reduce it. Some of the bottoms of the lamp-heads were completely open, and the tops too. They found it advisable to check the air-inlet at the bottom, to prevent any flickering, or sudden gusts of wind entering the lamp. The greatest importance, however, attached to the top of the lamp-head, as they found the down-draught did more damage than the up-draught. They checked this by putting in a little cone of perforated copper, or by surrounding the ordinary ventilator by copper or other equivalent according to the shape or size of the lamp. Out of the whole of the thirty burners, they had not had a single failure. They had been able to adapt the whole of the lamp-heads; and the experiment had been an unqualified success.

Mr. C. ELLIS, referring to the electric lighting undertaking at Yarmouth, said the Gas Company had found it a rival; but still they had been making headway against it—last year something consider-ably more than the year previous. As far as the street lighting was concerned, he did not know whether or not the Corporation had had sufficient of it; but since they had started the electric works, the Gas Company had come to terms with them to light by incandescent lamps, for three years, the principal streets not illuminated by means of electricity. The arrangement was based on the consumption of ordinary street-lamps—5 cubic feet per hour; and they had something like 120 of the incandescent lamps in use. These had been running for about twelve months; and he did not think the Corporation would be in a hurry to extend their arc lighting. The incandescent lamps were working very well indeed. They found it necessary to check the upward current of air; and by means of an ordinary leather collar over the copper tube, they prevented the wholesale destruction of the mantles, which now averaged per lamp about four per annum.

Mr. TROUGHTON, in the course of his reply, said he was pleased to hear Mr. Dixon give such an interesting account of Cowpen, as he happened to know that this place had been held up by parties advocating electric lighting as an example of prosperity. With regard to cheaper gas, that was one of the facts he wanted to press home in the short paper he had read. He thought it was of great importance to show the consumers and the ratepayers generally, that, by sticking to gas, they would be helping to bring down the price. They could not go about preaching continually. But, as one speaker had mentioned, gas companies were large ratepayers; and when they were threatened with the electric light by the local authorities, then was the time to educate the ratepayers. The reports made by the electricians were too glowing—at any rate, when looked at from the gas manager's point of view; and the public required enlightening as to the advantages that were to be derived from gas, in order that they might make a fair, unbiassed comparison between the two systems. With reference to the statement made by Mr. Dixon as to Thetford, the electric lighting plant

there, he believed, was originally put down for lighting the works of Messrs. Burl; and the installation was found to be of sufficient capacity for a few outside customers. It was not therefore fair to take Thetford as a town that was lighted by electricity.

Mr. C. SNELLING (Thetford) intervened with the remark that one of the largest customers had returned to gas, and was now using the incandescent light. He also mentioned that the Gas Company had lost the lighting of the Great Eastern Railway Station; and that the price of gas was 5s. per 1000 cubic feet for lighting, and 4s. 6d. for cooking purposes.

Mr. TROUGHTON (resuming) referred to Mr. Smithard's remarks as to the electric lighting of Chelmsford. He pointed out that the light was supplied by a large local firm of electrical engineers (Messrs. Crompton); and said, if they could supply it cheaply anywhere, they would do so at home for an advertisement. Still, as Mr. Smithard had shown, the townspeople were foolish enough to pay considerably more for the light than they would have to do for gas.

Mr. ELLIS: Recently the accounts of the Yarmouth Corporation Electricity Department showed a balance of £790 on the wrong side.

Mr. SMITHARD, replying to an inquiry as to the financial results of electric lighting at Chelmsford, said there was an admitted loss, but its extent was not publicly known.

Mr. TROUGHTON (continuing) pointed to the results of the working of the Worcester Electricity Department as already recorded in the "JOURNAL," and also alluded to the fact that there were dividend-paying electric lighting companies, but they all occupied specially favoured districts, with numerous consumers on a short line of cable. But if a company started in a small town such as East Dereham, where the residents were far apart, it would cost a considerable sum of money to lay down the cables, and there would be a large proportion of leakage. He believed the leakage at Worcester last year was 25 per cent. of the electricity generated. He was glad Mr. Barton had given them a few useful figures relating to the incandescent light, because that at the present time was a strong competitor of the electric light. Mr. Sharman had expressed the opinion that there was room for both gas and the electric light. Seeing, however, that, if there was a loss on the latter, the ratepayers had to "pay the piper," his (Mr. Troughton's) view was that, if they could prevent the light coming into the small towns they represented in the Eastern Counties, they would be doing the ratepayers a great kindness.

A hearty vote of thanks was passed to Mr. Troughton for his paper, on the motion of Mr. DIXON, seconded by Mr. WIMHURST, who remarked that the ready manner in which the paper had been produced only confirmed what he said at the last meeting—that, in appointing Mr. Troughton to the office he now held, they were putting the right man in the right place.

Mr. TROUGHTON in a few appropriate words acknowledged the vote.

PLACE OF AUTUMN MEETING.

On the proposition of Mr. WIMHURST, seconded by Mr. BARTON, it was decided to hold the next meeting at Retford.

The thanks of the members were then accorded to the President; and this brought to a conclusion the business portion of the *agenda*.

PRESENTATION TO THE LATE HON. SECRETARY.

Early in the evening, the members and several friends dined at the King's Arms Hotel; and more than usual interest attached to this social diversion from the day's work, in that the members were presenting to their late Hon. Secretary and Treasurer (Mr. H. Wimhurst) a handsome solid silver tea service, in order to show, in a tangible way, their high appreciation of the work he had done for the Association.

The PRESIDENT, in calling upon Mr. Grimwood to make the presentation, remarked that it was unnecessary for him (the President) to say anything, as all the members knew of Mr. Wimhurst's good qualities.

Mr. GRIMWOOD said: It appears to me that, if we have not come to the toast of the evening, we have come to the event of the day. As our President has said, most of us know the good qualities of our friend whose name he mentioned; and I am sure all present members of the Association not only know him well, but love him well. It is on this account a very great pleasure to me to be the mouthpiece of the members and the friends of the Association, to ask Mr. Wimhurst, our late Hon. Secretary and Treasurer, to accept from the hands of the members the spontaneous gift which now stands before us. There has been no difficulty in collecting the money to purchase these articles; it has been only too readily offered. And I am sure Mr. Wimhurst will value the gift not so much for its intrinsic worth, but for the feelings which have prompted his friends to subscribe for the testimonial. Of course, it is given for the purpose of showing our appreciation of his good qualities, more particularly in reference to his services as Hon. Secretary and Treasurer; and I fearlessly say that it is my opinion that, but for him, we should have had no Association for the Eastern Counties. Many of us are members of other Associations; but when Mr. Wimhurst started this one, we rallied round it. We are a disjointed community so far as distance is concerned; but, by means of the Association, we are now able to meet together. Our board to-night shows that success has attended us; and this, I say, is all due to Mr. Wimhurst. No one knows so well as the Past-Presidents the work that has devolved upon our friend, who has been Hon. Secretary and Treasurer since the inception of the Association; he has left no stone unturned to ensure its success. I ask him to accept this small token of our esteem, regard, and love for him; and I hope it will give him as great pleasure to receive it as it does us to give it.

[The service, as already mentioned, is of solid silver, and consists of four pieces—a tray, teapot, sugar basin, and cream jug. The total weight is 110 oz. The tray bears the inscription: "Presented to Mr. Harry Wimhurst by the members of the Eastern Counties Gas Managers' Association, in recognition of valuable services rendered to the Association as Hon. Secretary and Treasurer from 1888 to 1893.—April 15, 1896.]

Mr. WIMHURST, in thanking the members, said: Gentlemen, this to me is one of the most trying moments of my life, but one of the most pleasing. I hardly know how to find words to thank you sufficiently for the high opinion you hold of me and of the services I have rendered to this Association. What I have done has been in the way of a duty. From the time we commenced this Association, I considered it a duty I owed to my brethren in the profession; and I must say I feel proud of my offspring. We have now attained our seventh or eighth year; and when I remember we started this Association with a mere handful of members, and now have reached the respectable number of 70, I look with a certain amount of pride upon the success we have achieved. I do not feel that all this success, or anything like all of it, has been through my own exertions. I have been backed up by gentlemen—the Past-Presidents and the present President and the members of the Committee—from time to time; and, without their help, we should not have met with the success we have. The very high compliments that Mr. Grimwood has paid me are much too flattering—at any rate, I know he has a most generous heart; and I take them from whence they come. I wish I could only find adequate words to express my thanks to those gentlemen who have subscribed to this testimonial; but I can only say I accept it with much pleasure. I hope to hand it down as an heirloom to my children. I thank you most heartily; and my dear wife (who will take the greatest care of it) will do so too.

Several toasts and songs followed.

Imperial Continental Gas Association.—The Directors of this Association recommend a dividend of 5 per cent. for the half year ended Dec. 31 last, and a bonus of 1 per cent., both free of tax.

South-West of England District Association of Gas Managers.—The half-yearly meeting of this Association will be held at Sherborne next Tuesday, under the presidency of Mr. T. W. R. White. According to the circular issued by the Hon. Secretary and Treasurer (Mr. Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.), the first business will be the submission of the scheme for amalgamating the Association with the Southern District Association for the approval of the members. This will be followed by the President's Inaugural Address; and then two papers will be read—one by Mr. W. Stagg, of Bristol, on "The Production of Steam and Power;" and the other by Mr. E. C. Riley, of Swindon, on "Some Experiences in Incandescent Lighting for Workshops, Sheds, and Open Spaces." After the meeting, the members will dine together.

Professor Dewar on the Production and Properties of Acetylene.—In the course of a lecture on "Recent Chemical Progress," given last Thursday at the Royal Institution, Professor Dewar, F.R.S., commented on the great future opened out to synthetical chemistry by the employment of the temperature of the electric arc. Some of the most interesting results had, he said, been obtained from the electric furnace by the French chemist, M. Moissan, in the shape of carbides—stable bodies produced by the combination at high temperatures of carbon with various metals. Many of these carbides were decomposed by water; the hydrogen of the water combining with the carbon to form hydrocarbons. Thus with water some carbides, such as that of calcium, gave acetylene; others, like that of aluminium, gave marsh gas; while others again gave these and other gases, and, what was most wonderful, liquid petroleums. It was a curious fact that many years ago Professor Mendeléef speculated that the only reason for the immense localization of petroleum at Baku was that it was being generated there—he suggested by the action of water on carbides. His idea was rather smiled at then; but now it was his turn to smile. When acetylene was heated to a dull red heat, it was polymerized to benzene. Benzene was the basis of all the new modern colours; and thus by three direct stages we were able to reach the nucleus of all the colours hitherto manufactured from coal-tar products. First, there was the combination of lime and coke in the electric furnace; second, the decomposition by water of the carbide thus formed; and, third, the transformation into benzene of the resulting acetylene by means of heat. Professor Dewar concluded by briefly discussing some of the properties of acetylene; explaining, among other things, the cause of its extraordinarily great luminosity, which he said was due to its peculiar endothermic structure.

INFORMAL MEETING OF SCOTTISH GAS MANAGERS.

The Thirteenth Annual "Informal" Meeting of Scottish Gas Managers—convened, as customary, by Mr. J. M'Gilchrist, of Dumbarton—was held in the North British Station Hotel, Glasgow, on Wednesday last. Mr. A. Bell, of Dalkeith, presided. The attendance was probably larger than on any previous occasion.

Exhibition of Standard Meter Unions.

There were exhibited on the Chairman's table a set of steel standard meter unions which had been manufactured by Messrs. W. Motherwell and Co., of Kinning Park, Glasgow, for the Research Committee of the North British Association of Gas Managers. It may be remembered that the matter was brought before the Association at their meeting last year in a paper read by Mr. J. Napier Myers, of Saltcoats, and was remitted to the Committee. There were nine unions, ranging in size from ½ inch to 2 inches; and one or two taps for wet meters. The thread adopted is the Whitworth. The standards are proposed to be deposited with the Secretary of the North British Association, to be used by him in verifying meter-unions, &c., which may be sent to him. The unions were briefly referred to by Mr. M'Gilchrist at the close of the proceedings.

The Chairman's Address.

The Chairman opened the meeting by delivering the following address:—

Mr. Convener and Gentlemen,—I have to thank you for the honour you have conferred upon me by electing me to the chair of this informal meeting. I must, however, honestly confess that I occupy the position with reluctance. The honour was conferred upon me in my absence; and I have grave doubts of my ability to adequately fill the position. But I shall do what I can; and I am encouraged by my knowledge of previous meetings to hope that all those present will help me to make this one as pleasant and profitable as its predecessors, by fully and freely discussing any points that I may be fortunate enough to suggest or that may spontaneously occur to you.

I am sorry to say that the first duty that devolves upon me to-day is a mournful one. As you are all aware, we have recently lost by death Mr. R. Robertson, of Bathgate. From this chair (which he so ably filled a few short years ago) I am sure I only voice the feelings of the meeting when I say that we heard with deep regret of the decease of our friend. I presume it is the desire of the meeting that our worthy Convener should forward to the widow and family an expression of our sympathy and condolence in their great bereavement.

As our time is limited, I will not occupy much of it with preliminary remarks; but this I may say, that I think we have great cause for congratulation, seeing that we have got over the work and worry of another lighting season so easily, especially when compared with some recent winters. Happily, unlike some of my predecessors in this chair, I have no complaints to make either of "John Frost" or of labour troubles in those allied industries upon which the prosperity of our business, and our own comfort as gas managers, so much depend. It is also gratifying to learn, from the published reports in our technical journals, that there has been a great increase in the output of gas throughout the country. The only note of complaint is due to the very depressed state of the residuals market. But let us hope, for the sake of all concerned, that that cloud may be removed by an early return of general commercial prosperity.

I am aware that the success of past meetings has largely depended upon the Chairman's remarks being of such a character as to create discussion. That being the case, I was for some time at a loss for a subject endowed with such characteristics. At last I came to the conclusion that I could find no better text than the question put by our Convener to Mr. Young at the meeting of the North British Association last July, with reference to "high *versus* low grade gas," or "illuminating power and illuminating effect." I have nothing original to communicate on this point; neither do I intend to occupy much of your time with my own opinions, but rather to quote those of others of more consequence. Still, having had some little experience in the manufacture and distribution of different grades of gas, varying in quality from 15 to 30 candles, I may venture to give you my views for what they are worth. Some may be of opinion that the subject chosen is already overdone. I, for one, am not; for when we take into account the resources, energy, and ability of the gentlemen who have again brought it to the front, I question if we have heard the end of it. Indeed, I think it is a subject that deserves our earnest attention. Seeing that it was considered worthy of a special paper in the South, where their high standard is (say) 20 candles, it should surely prove worthy of discussion at a meeting of gas managers in Scotland, where the standard ranges from 24 to 28 candles.

In looking over the pages of our technical journals, I observe that the advocates of low-grade gas are practically unanimous (to put it shortly) in saying that the price of the raw material fixes, or regulates, the price of gas to the consumer. Permit me for a moment to examine this statement, and to consider some of the items, and their relative effects, which, in my opinion, regulate the selling price.

I think it will be generally allowed that we can as easily and economically manufacture, store, and distribute 28-candle as we can 14-candle gas. But the moment the illuminating power is taken into account, this equality ceases; for we can manufacture, store, and distribute, through the same plant, practically about double the units of light with a 28-candle that we can with a 14-candle gas. It is therefore evident that the capital charges per unit of light must necessarily be less with a high than with a low grade gas. Mr. Lewis T. Wright—a gentleman well qualified to speak on this subject—in a paper he read in London last year, said: "Of the selling price of gas in the Metropolis, 80 per cent. is made up of charges that are quite independent of the quality of the gas supplied; and that figure would be the same whether the gas was of 14 or 18 candle power." Mr. S. Glover, of St. Helens, also puts it very tersely in his paper read before the Institution of Gas Engineers. He says that the difference between the price per 1000 cubic feet to the consumer and the cost of the same gas put into the holder is "required to pay for storage, distribution, and other fixed charges, and to provide a profit;" and that "these fixed charges would remain practically the same for all qualities of gas." Taken broadly, I presume these statements are correct; at all events, I have never seen them challenged.

Let us now consider the raw material, less residuals, which, according to Mr. Lewis T. Wright, only represents 20 per cent. of the selling price, but which, as I have said, generally gets the credit of being the main cause of the high price to the consumer. I will only quote one very pointed instance to show really how little influence the price of the raw material (less residuals) has upon the selling price. At a meeting of the Sheffield Gas Company last September, the Chairman said that their accounts for 1894 showed a result with which he thought they had occasion to be gratified, for, after paying for their coals, the residuals left them "£924 to the good." And a little later, in answer to a shareholder who asked whether, under these circumstances, the price of gas could not be reduced from 2s. 2d. to 2s., the Chairman said they would not be justified in making such a reduction. That may be looked upon as an extreme case; but I think I am justified in quoting it, as it clearly shows how very little influence the price of the raw material, even where it is all coal and cannel, has upon the selling price of gas.

Examine now some of the reasons given for lowering the standard to the ordinary product of (say) Durham coal. Mr. George Livesey, whose opinion on this and all other matters connected with our industry deservedly carries great weight, has put it on record that, in his opinion, "enrichment was not worth what it cost, and that the consumer did not reap the benefit of it though he paid for it." To prove this, he tried the experiment of sending out unenriched gas for a fortnight, with the result that there were even fewer complaints of want of illuminating power than usual. Mr. Livesey, however, supplies the reason for "no complaints," when he says that their enriched gas failed to reach the consumer.

Professor Lewes seems to be of Mr. Livesey's opinion; at least so far as the Metropolis is concerned. He gave his reasons for holding that opinion very fully in an article in "Nature" in June, 1894. There, referring to the South Metropolitan experiment, he said that "tests made on consumers' premises, both before, during, and after the experiment, gave identical results—showing that the consumer gains absolutely nothing for what the enrichment costs him;" and the reason is that "the enricher is only a vapour and not a permanent gas, and is therefore deposited in the mains through friction and low temperature." I am sure we can all corroborate the latter statement from our own experience when using either cannel or shale enrichment; for during periods of low temperature, we are compelled to use a greater proportion of the enricher to keep up the illuminating power of our gas—the extra quantity being simply required to compensate for the illuminating hydrocarbons condensed and retained as a liquid in the gasholder and distributing plant. But with the return of warm weather, in spring or early summer, the pendulum swings the other way; and we sometimes have a difficulty in keeping down and steadying our illuminating power until the whole of the condensed hydrocarbons have been volatilized and taken up by the gas.

With this in view, I think the season of the year selected for the South Metropolitan experiment was hardly suitable for a fair trial. At the same time, we are all aware that by the beginning of May artificial lighting (at least for business purposes) is at a discount. Neither are our consumers so critical in summer as they are in the dark nights of winter. It therefore seems strange, in the face of their own evidence, and remembering that there are various other modes of enrichment in use which have stood the test of years, and which have been proved to be far more permanent than even cannel or shale enrichment, and at the same time not costing one-third of the price quoted by Mr. Livesey (1½d. per candle), that the only remedy Mr. Livesey and Professor Lewes can suggest is the lowering of the standard.

That there are such processes, we have ample evidence in Mr. Stelfox's Gas Institute paper, in Mr. Glover's Gas Institution paper, in Mr. Yuill's North British Association paper, and in his address from this chair last year. I have had three years' personal experience of oil-gas enrichment by the Peebles process; and I can heartily endorse Mr. Yuill's statement that this gas is far more permanent than that produced from first-

class cannels, and certainly cheaper, even at the present low rates for cannel.

We have only as yet been looking at this question from a manufacturing point of view. Let us now glance at the effect the reduction of the standard would have upon the consumer. Mr. Dibdin (no mean authority), in his report to the London County Council, says that "Mr. Livesey, at his interview with the Committee, was of opinion that, in the event of the abolition of the present system of enrichment, the price per 1000 cubic feet might be reduced a penny." But Mr. Dibdin says: "As the consumer would require to pay 18 per cent. more to obtain the same lighting value, it would be equivalent to raising the price of the South Metropolitan gas 4d., even after the reduction of a penny; and if the gas were lowered to 14 instead of 15 candles, that increase would be virtually doubled." His calculation, I may say, is based on the use of flat-flame burners; and as the great bulk of our gas is still consumed with these burners, his calculation holds good for either North or South. It is needless for me to quote further from Mr. Dibdin's able report, seeing that our Convener gave us a summary of it in his presidential address at the Glasgow meeting of the North British Association (1894).

I will just give one more quotation bearing on this point. Mr. Lewis T. Wright, in the paper from which I have already quoted, said: "After his experience in the manufacture of qualities of gas varying from London gas of 16 candles to gas of 25 candles, he was at a loss to understand the arguments in favour of the reduction of the standard of illuminating power in London. He considered this a retrograde step, and likely to lead to loss of prestige. He also considered that it was against economical principles, since to-day gaslight could be supplied cheaper at a high than at a low grade. He, however, acknowledged that the lower price appealed to the agitator; but quality appealed more to the consumer."

I may here remark that I observed that at a meeting of the Liverpool Lighting Sub-Committee "the question of reducing the candle power of the gas, so as to render it cheaper, was considered; but after reading a report by Mr. Bellamy that, light for light, the higher the illuminating power the cheaper the gas was to the consumer, a feeling seemed to prevail that it would be unadvisable to reduce the candle power at present."

I have been speaking of gas only as an illuminating agent. We are, however, all aware, and are glad to know, that lighting gas is daily becoming more used as a heat agent—for motive power, cooking, &c. It is often plausibly asserted by the advocates for the reduction of the standard that low-grade gas (say, 14 candles) is equal, as a heating agent, to 20-candle gas. I use the term "plausibly" simply because I cannot believe that they mean that low-grade gas has equal heating power per unit volume; but without this qualification, the statement is very misleading. I will again quote Mr. Lewis T. Wright, who, in answering the criticism on his paper, said: "In practice, as we increase the lighting power of a gas, we increase the carbon density and the hydrogen density, and, per cubic foot, we obtain, with increased lighting power, a corresponding heating power." Mr. Charles Hunt also, in a paper read before The Gas Institute (in 1882), gave the results of careful experiments upon the different qualities of gas in the Otto engine, and said: "The lower the illuminating power, the greater is the quantity required to perform the same amount of work." In a communication presented to the Académie des Sciences by M. Paul Aguitton, the Engineer of the Marseilles Gas-Works, and based on the result of most elaborate experiments, it is said that "it is proved that the calorific value of coal gas is of the same order as the illuminating power, and, if known exactly, it forms as good a criterion of the latter as determinations with candles of doubtfully constant light-giving power."* This is pretty rough on the candles; but it proves that M. Aguitton, at least, has no doubt about the heating value of the gas. And we have any amount of experimental and practical proof of these statements, such as those quoted by Mr. Yuill at the Melrose meeting, &c.

But with the knowledge we have gained through the classical papers of Mr. Young, Professor Lewes, and others, on the chemical constitution of coal gas, we are naturally led to expect such results. Mr. Young has, however, clearly shown us that the calorific value of coal gas does not advance exactly in the same ratio as the illuminating power; but the difference is so trifling that, when we consider that the great bulk of our gas is still directly used for illuminating purposes, it would be a serious blunder to sacrifice the interest of the many for the small saving it might prove to the few who use gas for heat only. We can easily conceive, however, that the day may come when a balance may be struck. When this happens, I have no doubt we shall be prepared to meet the altered conditions.

This question has lately been presented to us from another point of view, in which it is broadly asserted that our so-called high-grade gas is not equal in "illuminating effect" to low-grade gas. I presume it is needless for me to say that Mr. Thomas Newbigging is the latter-day apostle of this statement. I am sure we all admire Mr. Newbigging's literary and scientific talents, and must therefore regret that he has never (so far as I have seen) supplied us with either theoretical or experimental data to support the broad opinions he expressed in his Gas Institute paper. He even candidly says that he will not attempt to give any scientific reasons for the conclusions he has come to, further than to say that the statements made are the results of long experience and observation. I trust, therefore, we may be pardoned if we examine some of his conclusions at the bar of our own experience.

Mr. Newbigging agrees with Mr. Livesey in saying that it would be reasonable for the Legislature to fix such an illuminating standard as the quality of the coal available in a district will yield. At the end of the nineteenth century, this proposal, to my mind, looks like a step backward, and something very like our old friend Protection. With our rapid and regular means of communication, the whole world is now laid under contribution for the supply of both the necessaries and the luxuries of our civilization. Why, therefore, should the standard be fixed by the local supply of the raw material? Mr. Newbigging might reply with the old adage: "Why go farther and fare worse," as he argues that in towns supplied with low-grade gas there are fewer complaints than in towns supplied with so-called richer gas; and that this is notoriously the case in London, where complaints are exceedingly rare, and, when made, are groundless, or due to other defects than the illuminating power. My acquaintance with the London gas supply is too limited to enable me to form an opinion as to the contentment or otherwise of the consumers. I will, however, call a witness by quoting from a very able article which appeared in the "JOURNAL OF GAS LIGHTING" last September, entitled "London by Night." After a graphic description of London by night, the writer goes on to say:

> If a non-technical person who remembers how London was lit twenty years ago were to be told that the gas which does far and away the most of the same work to-day is of precisely the same quality still, so far as illuminating power is concerned, he would not quite believe the assertion. . . . The fact is that London is twice as brightly lit to-night as it was a quarter of a century ago; and though more gas is burnt, the effect is not wholly, or indeed principally, due to this cause. If any main thoroughfare is looked at during the business hours of the evening, hardly one source of light in a hundred will be found to represent the gas-lights of the period when the nominal quality of London gas was settled by law. Incandescent, regenerative, and albo-carbon lights will be seen in shop after shop; and outside, the huge coupled or tripled flat-flames in their massive lanterns indicate a scheme of lighting to which the framers of this law were strangers. Not once in a mile, if so frequently, will be found anything like the statutory burner by the use of which the Londoner might be supposed to be reminded that he is still supplied with 16-candle gas. What is this to him? Who but the professional examiner and the gas manager thinks or talks of 16-candle gas? It is a convention—a name. It has no part in determining the degree of brilliancy which London shall exhibit at night.

Time will not permit me to quote further from this very instructive article; but I think I have given sufficient to show that there is anything but contentment in London with the illuminating power of their present supply. It also shows, to quote an expressive phrase of our Convener, that "it is light the consumer wants, and not gas."

The very fact that the albo-carbon process was invented, and has been so extensively adopted, shows that, in the opinion of both the manufacturer and consumer, it is desirable to have a gas containing more of the light-producing element—carbon. Now, if this carbon can be put into the gas at the works at such a cost as will enable the manufacturer to supply, and the consumer to obtain, a given amount of light at a less cost (about that, I think, there is now no doubt whatever), it appears to me to be shortsighted policy not to follow that course.

We are told that it is to the interest of the gas manufacturer to increase the consumption and not to diminish it, as would be the case if a more luminous gas were supplied. But, as clearly shown by the writer in the "JOURNAL OF GAS LIGHTING," already quoted, if the gas makers fail to put the luminous matter into the gas, the consumers who wish more light will get it from some other source—either by the albo-carbon process, or by substituting for the carbon the oxides of the rare earths, as in the incandescent mantle, or by means of electricity. But light obtained from albo-carbon, from an incandescent mantle, or from electricity brings no profit to the gas manufacturer. It is only the light that he himself supplies that yields him a profit; and therefore it is to his interest to give as much of that as possible.

I am well aware that there are many gentlemen present who have, in the past, uttered no uncertain sound on this subject; but it is desirable that, by discussion now, we should know exactly how we stand with reference to it at the present time.

Discussion.

Mr. A. YUILL (Alloa) said he thought the address which the Chairman had delivered would be very beneficial. Before discussing it, he would make one remark about their late friend Bailie Robertson. Most of them remembered Mr. Robertson filling the presidential chair of the North British Association; and they all knew how he executed his duties then. He thought that they should ask Mr. M'Gilchrist to convey to Mr. Robertson's family their sincere sympathy. Coming to the address, in the past winter, they had not been called upon to face the same difficulties which they had in the preceding one, especially with regard to frost; and, so far

* Some account of M. Aguitton's work will be found in the "JOURNAL," Vol. LXII., pp. 355, 402.

as he could ascertain, most of them were in a position to chronicle a large increase in the consumption of gas. In the past, increases were thought to be synonymous with cold weather; but this had been found to be not the fact. Their Chairman had mentioned the difference between low and high grade gas. This was a subject which he himself went into at their last meeting; and their Chairman had dealt so well with it, that he did not feel he (Mr. Yuill) could say much more upon it. What he did feel was the persuasion that their experience with oil enriching was such that they had no reason to regret adopting it. They had had no complaints, properly speaking; any they had had not being in respect to defective quality of the gas, but to insufficient pressure in the mains. Their Chairman had spoken about the cost of enrichment. That was a point which he thought was worthy of some attention, because in enriching they were dealing with an article which cost, in his own case, without deducting residuals, from 25 to 27 per cent. of the total. Suppose it took 0·3d. per 1000 cubic feet to enrich from 16 to 28 candles, this did not amount to very much on the selling price of gas. He would rather, however, leave the subject to the discussion of others, because he had gone so much into it in the past that they might feel that he was talking "shop." Some fears had been expressed as to the permanency of oil gas; and those doubts, they found, were held by people who had no experience with it. All those who had experience in the working of oil gas were thoroughly convinced of its permanency. Their Chairman had touched upon the debateable point of illuminating power and illuminating effect. He would leave this part of the subject to be dealt with by their worthy Convener; but this he could say, that in all the experience he had had, consumers would prefer a gas of 28 candles to one of 16 candles—the price remaining the same.

Mr. A. MacPherson (Kirkcaldy): I should think so.

Mr. Yuill submitted that that was the point. It was asked what was the use of giving 28 candles, when they got a better effect with 16 candles. He had found the consumers say: "Never mind the illuminating effect; it is the illuminating power we want." They had heard a good deal about scientific discoveries; and it was just possible that a low illuminating gas might possess some virtues they were not yet conscious of—the Röntgen or other rays might be more generally developed. They knew that it was already possible to see through a brick wall; and they might follow on the same lines with low illuminating gas, for effect. But he questioned that.

Mr. J. M'Crae (Dundee) thanked the Chairman for the way in which he had presented his address; but, with all deference to him, there were one or two views with which he could not agree. In the first place, he would like the Chairman to tell them how it was possible that gas made by the oil process could be, as he said, "far more permanent" than that made from coal. He would like to be told the constituent parts of the hydrocarbons of the gas made by an admixture of gas and oil, and how they could be more permanent. He did not maintain that oil gas would not be as permanent; but the Chairman said "more permanent." Mr. Yuill remarked that there were certain persons who spoke about the oil process, and who had had no experience with it. He himself was one of them; and he only wished that those who had had experience with oil were quite satisfied with their experiments. Of that, however, he had very great doubts. He would like to ask Mr. Yuill what price his gas was sold at before he introduced the oil process; what his cost of production had been since; and what the price of gas was now, so that they might know exactly how he stood. There was one thing about that meeting which he was quite delighted to see—that was the homely, friendly feeling among gas managers. Many of them were in small situations; and he respected them very much, because they had far more experience than the managers of big works, having themselves to look into every detail. If these gentlemen would just speak out freely, they would all profit by it.

The Chairman, replying to Mr. M'Crae's question as to the permanency of oil gas, said that the mode of manufacture was quite different. As it was usually conducted in small works, the gas was washed in the oil which was coming down to the retort; and they were aware of the solvent action of the oil upon the vapours, and that not a particle of vapour which could be condensed, either by friction or cold, could pass that oil. They knew that when they were trying to recover ammonia from gas, they passed it through water, which had a solvent action upon ammonia to the extent of about 700 times its own volume. The oil had as powerful an action upon oil vapours as water had upon ammonia. They could put oil gas made in this way under enormous pressure, and yet get no liquor. He would give them a concrete instance of how it was more permanent than coal gas. He was manager of a small works, where his holder was only 60 feet diameter. They were rather limited in storage capacity; consequently in winter they worked pretty close to the margin, and he had seen the holder blowing occasionally. As long as they were working with shale or cannel enrichment, whenever it blew, the outside of the holder was covered instantly with the light hydrocarbons—the crude benzols—to the danger and the nuisance of everybody around it. It had to be skimmed off. He once saw in the Edinburgh works quite 4 inches of oil floating round the holder. In the winter before last, after beginning with the oil process, at the time of the severe frost, the water main-pipes were frozen; and before he could get anything rigged out to procure water, he had to draw some from the tank. That reduced the seal, and the holder blew three or four times; but not one single drop of oil came on those occasions. Not only that, but he went round all his street-traps, some of which were a mile and a half off; and there was not a drop of oil in any of them. The man who cleaned out the traps took a barrel with him, in which to bring back the liquor. Now, during the winter season, when they were using the oil process, he had discarded the barrel; but the moment they ceased to work the oil—which he had done now for the season, because of the small consumption, and began to work with coal only—the man again used the barrel. This, he thought, was pretty certain proof of its being permanent. Of necessity, it must be permanent.

Mr. M'Crae: Why?

The Chairman replied from the washing with the oil. If they put their cannel gas through oil, it would be the same. The oil left nothing but hard, dry gas; and therefore it would even add to the permanency of ordinary splint coal gas.

Mr. T. Wilson (Coatbridge) said he had listened with very great attention to the valuable address of the Chairman, in which there was certainly material for consideration. With regard to the permanency of oil gas, as shown by the condition of the street-traps, he might tell them that, in the town with which he was connected, they had not pumped the street-traps for 15½ years; and they enriched their gas with shale. Shale gas, therefore, might be quite as permanent as gas made from oil. He just wanted to give them that fact; and then he wished to ask Mr. Yuill one question.

Mr. Yuill understood that the discussion was taking place on the Chairman's address, and not upon the discussion itself.

The Chairman thought the discussion was general. They were there seeking information. They were told that low-grade gas, because cheap, was good for competition with electric light; but he said "No," because it was their duty to try to give their customers the best light they could.

Mr. Wilson said he was seeking information. The Company which he represented were opposed by an electric light company. They had been trying to make gas cheaply, and to sell it cheaply; and it was with this view that he wanted the information. Mr. Yuill stated that to raise gas from 16 to 28 candles cost 0·3d. Was that per candle, or for the 12 candles?

Mr. Yuill: Per 1000 cubic feet.

Mr. Wilson: That is 3·6d. per 1000 cubic feet?

Mr. Yuill: Yes.

Mr. Wilson: It is interesting to know whether the oil is really cheaper than the shale or not.

Mr. Yuill said that the Chairman had quoted Mr. Livesey, who put it at 1½d. per candle. They believed they enriched per candle for one-sixth of that, or even less.

Mr. Wilson: I take your answer that it is 3·6d. per 12 candles.

Mr. Yuill said he was speaking from memory; but if they referred to the paper he gave last year, the whole figures were contained in it, roughly speaking.

Mr. Wilson said he had been anxious to learn. If there really was a saving by the oil process, they would spend £1500 at once, and adopt it. He took it that it was 3·6d. per 12 candles.

Mr. Yuill asked Mr. Wilson to look up the proceedings at last year's meeting. He was prepared to stand by what he said then. As to Mr. M'Crae's question, he thought that, if he would refer to last year's proceedings, he would also get an answer.

Mr. A. Wilson (Dawsholm) remarked that, as he had said before, he might say again—that having been brought up in the South, he was inclined to the view that the lower-grade gas was the gas which gave the least trouble, and was the most economical in the end. Complaints from the consumers, he thought, were far fewer in the South than where a high-quality gas was sent out. That had been his experience. The lighting effect from 16-candle gas, generally speaking, seemed to be quite as brilliant as what they got in the North. Of course, they used more gas; but as a general rule, they did not pay so much for it, and they certainly seemed better satisfied with it. The Chairman raised the question about illuminating power and illuminating effect. He thought there was a great deal more in that than was generally believed. Perhaps some of them might try the experiment for themselves. He had been going into that a little himself. If they were to take an incandescent burner, and use it naked, they would certainly have a much greater illuminating power. If, however, they put a large opal globe under it, and threw the light up to the ceiling, by the reflection down, they would not have such a high illuminating power, but they would obtain a better illuminating effect. They would find, on that line, something of the difference between low and high quality gas. They would discover that they could do more work with their eyes, and that these would be less strained, with a reflected light, although there was not the same illuminating power. They would have more diffusibility than from the small jet which was usually used in the North. With the low-quality gas, they had a much larger flame, which gave a more mellow light. They could open their eyes wider in it; and there was not such a strain. If they tried to read in the sunlight, and in a room where the sunlight was away from them, they would find that they would be able to do more in the room than in the sun. There was, therefore, he thought, much that was well worth considering in the question of illuminating power and illuminating effect.

The CHAIRMAN asked if Mr. Wilson's statement was that, when they burned more gas, consumers got a better lighting effect. Could he say how much more gas was burned? How much did it cost per annum? It was the unit of light they should reckon from. If a consumer required 2000 cubic feet of gas to do the work which they could do with 1000 cubic feet, it would cost them more, would it not? With regard to illuminating power and illuminating effect, Mr. Wilson said there was more in it than they probably had considered. Mr. A. C. Humphreys, of New York, and many scientists, had gone into that very fully. Some ten years ago, this question was raised between the water-gas and coal-gas men. The latter made an affirmation that the light from 16-candle gas was equal to that from water-gas of 22-candle power. The challenge was taken up; and most elaborate apparatus was fitted out for the purpose of testing the illuminating power and illuminating effect. After days and days of trial by some of the greatest men in America, they found it was absolute nonsense. In the case of the opal globe, they had a larger volume of light; they had not only the direct rays but the convergent and divergent rays, all in one mass; and the shadows were lighter and not so dense. Comparing a 14-candle gas with 20-candle gas, he declared that the diffusion was as good with the one as with the other. Of course, the light might be hurtful to the eye; but this would be because they were using it the wrong way.

Mr. A. WILSON said it was in the interest of the water-gas people to make out that a small burner with a high illuminating power was the best; but he would just advise any of them who had doubts about the matter to try it for themselves. They would certainly find that, with a large volume of light, they could do more work. Speaking from memory—it was some years since he left London—the lighting in London appeared to be more pleasant than it was in Scotland.

Mr. A. MACPHERSON thought, with Mr. Wilson, that there was a good deal to be said for illuminating effect. In discussing this question, they sometimes missed the point that with a small-sized burner and high illuminating power gas, they had intensity at the point of combustion. Say that they used a burner consuming 2½ cubic feet, they would have a small but intensely bright flame. In England, they would possibly employ a burner consuming 4½ cubic feet, to get the same illuminating power; but they must remember that that would give a much larger flame. They knew that the radiation of light from the larger flame would be much better diffused; and consequently he had no doubt might—he should not like to say would, because he had merely thought over the question, without experimenting—give a better illuminating effect. If they took the electric arc light, they knew very well that they did not get the diffusion which they were entitled to expect, from its intensity at the point of the arc. He thought they were right in maintaining high-quality gas. There might be some little gain in illuminating effect; but he believed that, if it were for nothing but sanitary reasons, they were entitled to maintain the high quality, in order to keep a purer atmosphere. The advocates of low-quality gas did not seem to consider that. There was no doubt that low-quality gas, light for light, would vitiate the atmosphere of rooms to a greater extent than would that of high quality. The cost, he believed, relatively speaking, was in favour of high-quality gas. The price of gas in England, he thought, they might take at 2s. 3d. per 1000 cubic feet, on an average. In Scotland, he believed they would find that the gas supplied was generally at least 50 per cent. higher in illuminating power; and that the great majority of Scotch gas companies were charging a little under, he should say, 50 per cent. more than 2s. 3d. per 1000 cubic feet. Consequently they were on the right side, both from the sanitary and economical point of view, in supplying a high-quality gas; and it would be very bad policy on their part to let their rich cannel fields lie waste while they could get cannel, at a moderate price, to make such beautiful gas. In regard to the washing of the enriched oil gas with oil, it was quite true, as their Chairman said, that anything which was not cracked up thoroughly would be washed out by the oil; and he had not much doubt himself in regard to the permanency of oil gas. But the statement that it was more permanent than coal gas would, he thought, require a great deal of proof; because, if coal gas were sufficiently condensed, they would not be very much troubled with their traps, any more than Mr. Bell was with oil enrichment. If Mr. Bell had been troubled with pumping oil out of the traps, he would excuse him if he said that he had not been giving the coal gas justice—he had not been sufficiently condensing it.

The CHAIRMAN: I was speaking only of when there was 30° of frost.

Mr. MACPHERSON said they knew that, if they made it into permanent gas, 30° of frost would have very little effect upon it. It should be their duty to see that the gas they sent out was permanent. He had no doubt that Mr. Livesey's experiment with enrichment would be a mere mechanical suspension of an enriching mixture, which, they knew, would be deposited, and would never reach the consumers' registers. Mr. Livesey might be quite right in saying it was not worth putting in to simply let it drop in the street mains. In regard to the economy of using oil, of course those gentlemen who had employed it were the best judges of whether it was economical or not. As he had said before, he found that it was as cheap to use cannel coal as to use oil; and therefore he had never gone in for the oil process. But doubtless in many places it would be far cheaper to enrich by the Peebles process, than it would be to pay heavy carriage on high-class cannels.

Mr. J. BALLANTYNE (Rothesay) said it seemed to him that the discussion upon high *versus* low quality gas should not be so much a question with them of between 14 and 30 candle gas, as between 23 or 24 and 30 candle gas. He knew, from his own experience, that there was such a thing as lighting effect *versus* luminosity. Some years ago, they were very much pressed for storage accommodation; and they had to use large quantities of No. 1 Niddrie coal. There were then many complaints; but when they used such a coal as No. 1 Lanemark, it seemed to be different. It was found that the illuminating power was very much dependent on the yellow rays. The rich coal gave the yellow flame; whereas the other gave a fine, white, soft flame. It was illuminating effect which their consumers wanted more than high candle power. They did not know anything about candle power; and it was all the same to them, so long as they obtained lighting effect. From his experience, it seemed to him that so long as they could give their consumers a fine, soft flame, they would be quite satisfied, and that they did not wish a heavy, yellowish flame. A great many people thought that they got a better light from a paraffin lamp. The reason was that they obtained a white flame from it; it was the effect which they looked to, and not the lighting power. In Rothesay, they did not use oil; and he knew that the great majority of their traps had not been pumped for the last eight years. He believed that for a longer period than that, from two-eighths of them nothing had been taken out; and they had an enormous extent of mains exposed along the shores, and should have a deposit there, if anywhere. He had no photometer; but he thought the gas he supplied was of from 23 to 24 candle power.

The CHAIRMAN asked if it never struck Mr. Ballantyne, when supplying the higher-quality gas, to alter the burner. That was the reason why he was getting the yellow flame, the smoke, and the complaints. They could all burn gas of 28-candle power just as easily as that of 14-candle power; it was simply a matter of burner. With reference to his traps, Mr. Ballantyne should look at his mains, and see if the joints were all right; he was afraid that was where the deposit was going to.

Mr. BALLANTYNE remarked that they could not get consumers to change their burners all at once. He had examined his mains several times, and had not found them leaking; and he had reduced the leakage from 17 to 8 or 9 per cent.

Mr. A. WADDELL (Broughty Ferry) said that in his town, where they used to make gas from shale and cannel, he believed that the traps had not been pumped for eight or nine years; nor had they had anything in their traps since they changed to enrichment by oil. Their leakage, too, was about the lowest on record—it was as far down as 3 per cent. He was asking for information. In the last place he was in, they made gas of 16 or 17 candle power; and there had been no traps pumped there for a very long time. Both there and at Broughty Ferry, he noticed that the sub-soil was sand; and he wondered whether this had anything to do with it. It seemed to him that the Chairman had very fully answered the question as to the permanency of the gas.

Mr. R. S. CARLOW (Arbroath) said he had not had any experience with oil gas; but so far as coal gas was concerned, he could speak with some confidence. He had been fifteen years in Arbroath, and had manufactured gas there under all circumstances; and so far as the traps were concerned, there had been little bother with them. He had had no experience of hydrocarbons floating on the top of the tank. This gas seemed to be thoroughly permanent. When he went there, the leakage was 15 per cent.; and for the last eight or ten years, it had been about 6½ per cent.

Mr. T. WILSON asked the Chairman, with reference to his remark to Mr. Ballantyne, if it had not been his experience that, when the pipes or joints were faulty, it was there that they got their traps full; if the pipes were all right, the traps were all right.

The CHAIRMAN said that, of course, when the pipes were leaking, they sometimes let in water; but he had no doubt it was within the experience of all of them that, when warm weather came, the water went away. Where did it go to? He hoped it did not go to the consumers, and get paid for as gas.

Mr. T. WILSON said he might tell them that he had a staff of five or six men doing nothing else but looking for fractures in the pipes. They were in the centre of the Scotch coal-field; and they had many fractures. They got the joints sometimes separated by a very wide gap.

The CHAIRMAN remarked that that was a confession. If Mr. Wilson got his pipes in that condition, where could the water lie?

Mr. BALLANTYNE asked why they took 30-candle gas, and not 35, or higher.

Mr. CARLOW said that was just it; but was the "game worth the candle?"

The CHAIRMAN said everyone must speak according to his circumstances. He knew of a town in Scotland where they were supplying gas of 30-candle power; and he could guarantee them that there, if they were to supply gas of 27-candle power, the electric light would be in immediately. If they dropped by a single candle, there were complaints.

Mr. J. M'GILCHRIST (Dumbarton) said he thought the subject

had been pretty well thrashed out; and there was nothing left for them but to thank Mr. Bell for his conduct in the chair, and for his address.

THE ACCIDENT AT THE FORFAR GAS-WORKS.

Mr. M'GILCHRIST said there was another matter which was of the very greatest interest to gas managers generally—viz., the explosion at the Forfar Corporation Gas-Works, which might be brought forward. It was a very regrettable incident, as they all knew. When the Board of Trade took the matter up, many of them thought they would have some fair line drawn as to how the explosion occurred; but instead of that, Mr. Vernon Harcourt's report made confusion worse confounded. Really that report, from beginning to end, seemed to be very self-contradictory. Mr. Waddell was present; and if he had no objection, they might discuss the matter. It was of importance, because, as they would observe from the report, if any accident took place through the negligence of the gas manager, the whole of the cost of the investigation could be charged to him.

Mr. FORBES WADDELL (Forfar) expressed his willingness to have the matter discussed.

Mr. T. WILSON suggested that, seeing that Mr. Waddell's Commissioners had not discussed the report, they should not enter into a discussion there, but should ask Mr. Waddell to read a paper on the subject at the meeting of the North British Association of Gas Managers.

After remarks by several gentlemen, this course was adopted.

THE STANDARD UNIONS.

Mr. M'GILCHRIST said they had some time before them in which they could see the standard unions and couplings on the table; but that was no part of the business of the meeting—they were brought there simply for the Committee.

APPOINTMENTS.

Mr. M'GILCHRIST proposed that Mr. W. Smith (Ayr) should be appointed Chairman for next year's meeting.

This was agreed to; and Mr. Smith intimated his willingness to accept the office.

On the motion of Mr. A. MACPHERSON, Mr. M'Gilchrist was thanked for his conduct as Convener of the meeting, and was asked to undertake the duties of the office for another year.

Mr. M'GILCHRIST consented to do so.

The business of the meeting then terminated.

Those who had attended, along with a few friends, afterwards dined together in the same hotel—Mr. Bell presiding.

The Transfer of the South Molton Gas-Works.—A letter from the Local Government Board respecting the proposed date of transfer of the gas-works from the Gas Company to the Corporation was read at the meeting of the South Molton District Council last Tuesday. The agreement with the Company provides for the transfer taking place on June 24. But at the inquiry recently held, the Local Government Board Inspector pointed out that difficulty might possibly arise from the fact that the Provisional Order will not then have received the Royal Assent. The Local Government Board now wrote suggesting that the date of the transfer should be Sept. 29 or Dec. 25. It was decided to formally adopt the later date; but the Corporation will undertake the management as from June 24.

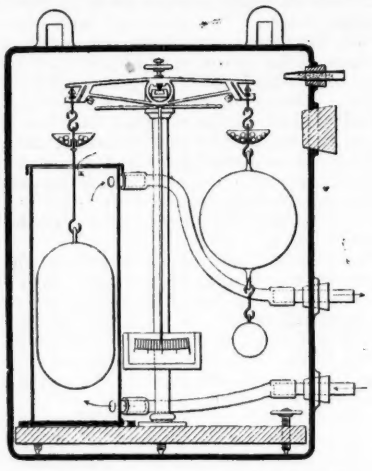
The Brighton Corporation Bill.—The Worthing Corporation last Tuesday rescinded their resolution to oppose the Bill of the Brighton Corporation, by which the latter seek power to purchase the undertaking of the Shoreham Water Company; but the opposition of Hove will be continued in the Upper House. The Bill as amended by the Commons Committee was considered by the shareholders of the Company on the above-named day; and an interesting point relating to charges was mentioned as having been settled under peculiar circumstances. During the hearing of the preamble, an agreement was come to that the maximum charge for domestic purposes in the districts of the Shoreham Urban District Council and the Steyning East and West Rural Districts Councils should be 1s. on the rateable value; no reference being made to a minimum charge. When, however, the clauses had been settled by the Committee, it appeared that the old minimum charge of 10s. was left in the Bill. Notice was at once given to the Committee for a re-opening of the proceedings—a request which was acceded to; and it was agreed that the minimum charge should be reduced to 7s. 6d. Mr. Pember's statement at the close of the Committee's proceedings, as reported in the "JOURNAL" last week (p. 813) requires amendment in this particular. The shareholders sanctioned the proceedings so far taken.

Automatic Gas-Meter (1895) Corporation, Limited.—The statutory meeting of this Corporation was held in the Memorial Hall, Manchester, on the 31st ult.—Mr. Francis Fleming in the chair. The Chairman explained that the meeting was of a purely formal character, and was called in pursuance of the Companies Acts. It was his pleasant duty to inform the shareholders that the demand for automatic gas-meters was still on the increase, and that, in his opinion, the system of automatic gas supply would soon become, as far as small houses were concerned, the recognized one throughout the country. As yet the Company were only supplying some 160 to 200 meters per week; but the new works were being pushed on with all despatch, and when completed they would be fully equipped with every modern appliance for turning out work expeditiously and of the very best quality. The Company also intended to manufacture all classes of ordinary meters in addition to those on the "penny-in-the-slot" system. A shareholder asked how soon the new works would be in operation. The Managing-Director replied that they were being completed in sections. He hoped that within four months they would be able to turn out from 500 to 700 meters per week, and that the number would be increased weekly until they reached the limit of their capacity, which he considered to be somewhere about 2000 per week.

REGISTER OF PATENTS.

Weighing Gases.—Arndt, M., of Aix-la-Chapelle, Germany. No. 6211; March 26, 1895.

The gas-weighing apparatus of this invention (as shown in the engraving) comprises an air-tight casing in which is enclosed a balance, from one of the ends of the scale-beam of which is suspended a hollow vessel, so as to be able to move up and down within a gas-container. The other end of the scale-beam has suspended from it, in ordinary air, a globular weighted vessel, to exactly balance the vessel in the gas-container when this is full of air. The gas to be weighed is conducted

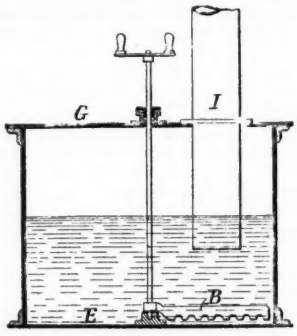


from outside the air-tight casing (through a tube) to the gas-container; and it flows out of the latter through another tube to the outside of the apparatus. To the middle of the scale-beam is fixed a long pointer the extremity of which, when the scale-beam oscillates, travels over a scale fixed upon the vertical standard of the balance, so as to indicate the difference between the weight of atmospheric air and the gas. The gases to be weighed are drawn through the gas-container by suction. The casing is provided with closeable apertures for the admission of fresh air when necessary, and also for the adjustment of the balance beam by the addition or removal of weights. Fresh air is admitted to the casing, to compensate for any escape from the gas-container to the surrounding air.

The globular vessel suspended in the air-space may also be enclosed within an air-container; and the gas-container, instead of being within the casing, may be placed outside, and may be shut off from the air-space by means of a liquid seal—the gas-container discharging some of the gas through a bell-shaped vessel, the bottom edge of which dips into a liquid. The gas, before its discharge, and in order to weigh the same, acts upon the hollow vessel within the gas-container, which is provided with inlet and outlet pipes for the gas. The vibrations of the hollow vessel are transmitted to the scale-beam and pointer through a frame, which at the upper end is attached to the scale-beam through a rod; and at the bottom end, it dips into the water-seal, and then rises upwards to engage the eye of a rod, from which the hollow vessel is suspended, and which (acted upon by the gas) causes the scale-beam and pointer to vibrate.

Fittings for Water-Gas Washers.—Cutler, S., of Millwall. No. 9538; May 14, 1895.

In the manufacture of carburetted water gas, the patentee remarks, it is usual to pass the crude hot gases from the generating vessels



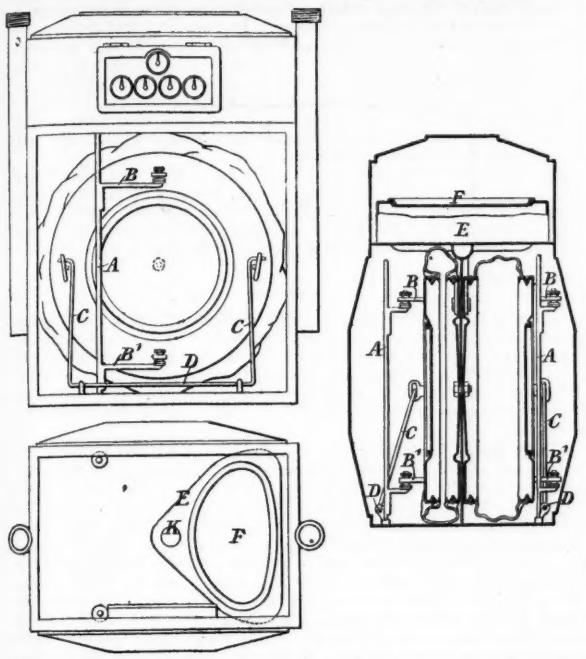
through a washer containing water, oil, or other liquid; and the gas-inlet pipe to such washers is immersed in the water or other liquid to form a seal, for preventing the gas from passing back to the generating vessels when out of action. "It is found in practice that a deposit of carbon, dust, and grit, or other solid matter, collects beneath this gas-inlet pipe; and to remove it necessitates putting the apparatus out of action while the interior of the washer is cleaned."

To remove the deposit, it is proposed to provide in the interior of the washer shown in the engraving a radial arm B, attached to a vertical spindle, which has its lower end carried in a footstep on the bottom plate E, and its upper end passed through a stuffing-box in the cover G of the washer, and terminated with a handle by means of which it may be readily revolved. By rotating the spindle, the radial arm is caused to traverse beneath the bottom of the gas-inlet pipe I,

and thus remove the deposit of solid matter, which, being broken into small particles, is carried away in the effluent liquid. This operation may be performed without impeding the action of the washer.

Dry Gas-Meters.—Wright, F., of Westminster. No. 10,075; May 22, 1895.

This invention relates to the construction of the bellows and valve chamber of a dry gas-meter, in such a manner as "to save cost in their manufacture and to give ready access for inspection and repairs."



The illustration shows a front view of the interior of a dry meter (the front wall being removed), a plan of the upper part, and a vertical section.

Each bellows consists of two heads of sheet-metal, formed with a bead and a groove, in which the edge of the leather is secured as described in patent No. 3556 of 1892; but, according to the present invention, each head is stamped with a central hole having a conical lip projecting inwards around the hole. The cover is stamped with a lip forming a corresponding conical boss; so that, when the coned part of the cover is pressed into the coned part of the head, it makes a gas-tight fit; but the cover can be readily removed when required to give access to the interior of the bellows. In order not to interfere with this free access, instead of one central arm projecting from each flag-rod A two arms B B^1 are connected to studs projecting from the bellows head—one above, the other below the central opening; the head being supported as usual on the two side arms C, projecting up from the rocking-shaft D, which is mounted below. Instead of attaching the inner heads to the central partition by solder, both are fixed to it in a detachable manner by a central bolt and nut, to which access can be had on removing the cover. The valve-chamber E is stamped with an approximately oval opening in its top, having an inwardly projecting conical lip like that of the hole in the head; and a cover F for this opening is stamped with a corresponding conical lip forming a boss, which, when pressed into the hole, makes a gas-tight fit.

The invention also has relation to an improved form of tangent, so made that adjustments of the proper relation of the crank throw to the motion of the flag-rods driven by the action of the leathers or diaphragms may be regulated, and their stroke controlled. For this purpose a small flanged platform is provided of brass, having a boss with a socket or hole of such a size as to fit the top of the crank-spindle tightly, and further fitted with a screw for fixing it firmly to the crank. This small table or platform has a hole drilled eccentric to the crank-spindle, and its flanged edge in an opposite direction to the eccentric screwhole is milled or knurled.

Treating Heavy Hydrocarbons by Heat, especially applicable for the Manufacture of Oil Gas.—Pitt, S.; a communication from La Société Internationale des Procédés Adolphe Seigle, of Levallois Perret, France. No. 23,235; Dec. 4, 1895.

This invention has for its object "the transforming or cracking of heavy hydrocarbons—such as the heavy oils and coal tars, schist oils, petroleums, and the like by means of heat." By this apparatus "the molecules of the different hydrocarbons which constitute the heavy oils, petroleum oil, and schist oil, may be dissociated in such a manner as to transform them into lighter hydrocarbons, which are of much greater value."

The apparatus is characterized: 1. By the use of a bath of lead, heated in any suitable manner, but preferably by the combustion flue described in patent No. 18,518 of 1895. This bath of lead has for its object to maintain the apparatus at as constant a temperature as possible. 2. By the separation of the apparatus into elements of two kinds—namely, elements vaporizing by circulation, and elements for treating by means of heat the vapours generated by the first. 3. By a specially constructed apparatus—called a classifying condenser or heat exchanger—which has for its object both to permit the unequally liquefiable vapours to be collected at different levels, to separate by condensation the vapours not yet sufficiently heated, and to progressively heat the heavy hydrocarbon to be treated, which does not go into the vaporizing elements and the apparatus for treatment with heat until it has fallen in thin streams in a contrary direction to the ascending vapours, and has been charged with those vapours which should be returned to the heating apparatus. 4. By an automatic arrangement for regulating the temperature of the metallic bath by means of a pyrometer acting upon the delivery mechanism of the gasifier or sprayer of the heavy hydrocarbons serving as fuel.

Incandescent Gas-Burners.—Bousfield, J. E.; communicated from J. C. Spinn and Sohn, of Berlin. No. 23,346; Dec. 5, 1895.

In order to avoid the disadvantage found to exist in many incandescent gas-burner bodies—of the wire gauze at top filling up with dust, &c., and so causing a partial stoppage of the gas supply to the mantle—the patentees propose to substitute plates with radial slits in the burner-heads.

Igniting Devices for Gas-Jets, and a Process of Manufacturing Same.—Neumann, A., of Berlin. No. 24,207; Dec. 17, 1895.

This igniting device is based upon the fact that platinum in a finely-divided state readily absorbs oxygen. Platinum, in the form of platinum black, has already been used, says the patentee, in oxy-muriatic matches, to serve as automatic igniting devices for hydrogen gas. It has, however, been found that, for igniting gas-jets, platinum black is not applicable. He has therefore experimented upon other metals of the platinum group, and has found that "a mixture which contains platinum, osmium, and irridium in certain definite proportion, will fulfil the intended purpose in a perfect manner." A convenient proportion is obtained by combining the three metals in equal parts.

The process of production is as follows: One part of osmium and one part of iridium are dissolved in aqua regia; and the solution is evaporated to dryness. In the same manner, one part of platinum is dissolved in aqua regia; and the solution, which contains the platinum in the form of the chloride, is evaporated. The residues thus obtained are mixed, and heated to incandescence in a vacuum. During this operation, the mixture forms a cohesive slag, which is capable of being divided into small coherent pieces, when taken out of the vacuum, which pieces absorb atmospheric oxygen, and then are ready for use. For this purpose, a small piece of the material is secured above a gas-burner (of any construction) by means of a thin platinum wire, in such a manner that, on opening the gas-cock, the jet of gas will impinge on the substance, and become ignited, from the fact that "the oxygen absorbed by the mixture has assumed the qualities of ozone."

Regulating the Supply of Gas to Railway Coach Compartments.—Procter, H. T., of Victoria Street, Westminster, and Gill, R. E., of West Hampstead. No. 156; Jan. 3, 1896.

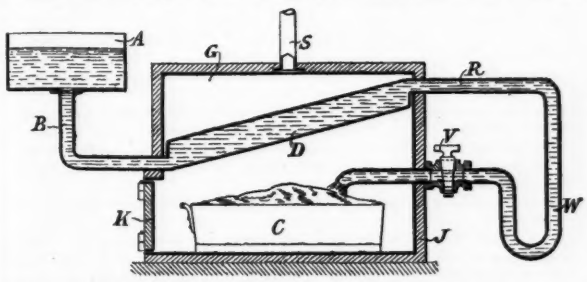
Patent No. 1377 of 1895 described the supply of gas to railway coach compartments being automatically regulated by means of moveable seats, which, when depressed by a passenger sitting thereon, actuate, by a system of levers, rods, and springs, a gas-cock fitted into the supply-pipe to each compartment—thus turning the light up, and in like manner turning it down when the seat is released by the passenger getting up. The present invention provides for a simpler means of accomplishing this object by improvements in the form of gearing to actuate the gas-cock, in the design of the moveable seats, and in the methods of adapting the invention to various kinds of rolling stock.

Production of Acetylene Gas.—Rossbach-Rousset, F., of Tempelhof, near Berlin. No. 1116; Jan. 16, 1896.

The patentee remarks that the processes and apparatus hitherto known for the generation of acetylene gas for illuminating purposes "have the disadvantage of producing fluctuations in the gas-generating vessel, and in consequence thereof, irregularly shaped and unsteadily burning flames;" and the object of this invention is to suppress this disadvantage.

G is a casing, in which is placed a container C charged with calcium carbide, introduced after opening the door K. S is a pipe jointed to the casing, and through which the acetylene generated is conducted to the place where it is to be used. Through the casing passes a pipe B D R W, the free end of which is returned through the side J of the casing, and is there provided with a cock V, the open end of which comes over the container C, and is in communication with the water reservoir A past the cock, or shut off by this latter from the same. The part D of the water-supply pipe immediately over the carbide container is enlarged to form a chamber; while the part W has arms of unequal length, and its bottom portion is bent to U shape.

The apparatus operates as follows: The container C, filled with calcium carbide, is placed in the casing G. The reservoir A is charged



with water; and the cock V is opened. The water then flows in unregulated quantity (and therefore in excess) on to the carbide, and forthwith produces, in the vessel G, a pressure exceeding that normally required for the development of the gas-flame. This excessive pressure also passes into the end of the supply-pipe, and causes a return flow of the water, and the complete interruption of the supply. Of the water

thus detained, the portion which is in the chamber D, being highly heated by the great heat (which, as is known, is at once generated upon the evolution of the gas), is partly converted into vapour or steam, which collects in the upper part of the chamber D and in the pipe part R. The latter is located outside the casing G, and is kept cool by the outside temperature. Consequently, in this pipe partial condensation of the steam takes place; and the water of condensation thus formed gradually passes over into the long arm of the pipe W, to which end R is laid at a slight inclination to the horizontal plane. In this way, the water will in a short time gradually overflow in the short arm of the pipe W, and thence pass in small quantity to the carbide container.

So soon as the above continuous equable action comes on, the apparatus will continue working as described. This continuous action is derived from the gas pressure in the casing G, and is always maintained, as so soon as fluctuations of pressure commence—for instance, if the pressure in the casing G begins to rise—the water present in the pipe W and in the chamber D is driven backward. The water flowing backward in the part W is thus elevated in the long arm of the same; and the space and the surface for the purposes of condensation are thus diminished. The quantity of water exposed to vaporization—that is to say, the vaporizing surface—is at the same time diminished by the water flowing backward into the chamber D. Therefore the result of an increase of pressure is a decrease in the vaporization and condensation; and consequently there is a decrease in the supply of water. The contrary obviously obtains when the pressure in the casing G commences to diminish, as then the vaporization and condensation (and consequently also the supply of water) are increased. In this way, the supply of water to the carbide of calcium in the container C is regulated exactly in the proportion required to maintain constant the pressure in the casing G.

APPLICATIONS FOR LETTERS PATENT.

6874.—Clay, W. R., "Improvements in or appertaining to burners for use in incandescent gas lighting." March 30.
6919.—Dowson, J. E., "Combustible gas." March 30.
6922.—Lewes, V. B., "Illuminating gas." March 30.
6930.—Mewburn, J. C., "Treatment of acetylene for illuminating and other purposes." A communication from A. C. Fraser. March 30.
6974.—Cundall, J. S., R. D., W. D., & H. C., "Motor engines operated by oil, gas, and other explosive matter." March 31.
6985.—Hawkyard, J., and Braddock, J., "Prepayment gas-meters." March 31.
7036.—Duryea, J. F., "Gas and other motors." March 31.
7057.—Lamplough, F., "Pumps, water-motors, water-meters, &c." April 1.
7067.—Richmond and Co., Limited, and Richmond, E. W. T., "Gas-heated laundry irons and like instruments." April 1.
7072.—Eccles, J. E., "Gas-stoves for cooking." April 1.
7082.—Wild, A. G., "Production of acetylene gas for use upon railway carriages and other vehicles and places." April 1.
7102.—Russell, D. K. C., "Construction of reservoirs." April 1.
7122.—Deighton, W., "Drilling and tapping gas or other main pipes." April 1.
7124.—Imray, O., "Production of ammonia and ammoniacal salts by means of the nitrogen of atmospheric air, or of that contained in combustion gases of any kind." A communication from La Société Christiania Minekompani. April 1.
7147.—Auriol, P., "Gas and oil engines." April 1.
7159.—Attenborough, E., "Incandescent gas and like burners or fittings." April 1.
7163.—Johnson, R. & C. E., "Gas and other explosion motive-power engines." April 1.
7226.—Schroeder, G. G., "Gas-enriching apparatus." April 2.
7233.—Duke, J. F., "Incandescent gas-lamps." April 2.
7243.—Clarke, W. C., "Generating illuminating gas." April 2.
7254.—Krieger, G. F., "Electric igniting devices for gas-burners." April 2.
7282.—Stock, T. S., W., B., & Taylor, H. W. & T. L., "Syphon flushing-cisterns and water-waste preventers." April 4.
7286.—Billington, C., jun., "Removing scurf or retort carbon from gas-retorts." April 4.
7289.—Brocklesby, H., Gratrix, S., jun., and Gratrix Bros., Limited, "Gas-brackets, pendants, and the like." April 4.
7308.—Proctor, J., "Mechanical stokers." April 4.
7326.—Slaby, F., "Incandescent gas-lamps." April 4.
7353.—Redman, T., "Supporting gas-burners and incandescent mantles." April 7.
7363.—Pursey, T., "Gas-burner fittings." April 7.
7367.—Hill, H., "Mantles or hoods for incandescent gas-lights." April 7.
7377.—Casley, W. H., and Woodman, A. F., "Gas, oil, or similar motors." April 7.
7397.—Teichmann, L., and Hopkins, E., "Protecting the mantles of incandescent burners when removing the chimneys." April 7.
7429.—Léry, J. B. de, "Mantles for incandescent gas and oil lamps." April 8.
7438.—Oehlmann, E. H. C., "Incandescent gas-burners." April 8.
7463.—Denayrouze, L., "Incandescent gas-lighting." April 8.
7477.—Schroedter, P., "Incandescence gas-burners." April 8.
7516.—Winkelmann, G. E., "Centrifugal oven for oil stoves, lamps, or gas." April 9.
7603.—Lanchester, F. W., "Gas and other motive-power engines." April 10.
7693.—Woog, P., "Lamps and apparatus for the generation and combustion of acetylene gas." April 11.
7700.—Catterson and Sons, Limited, and Catterson, W. P., "Globes or glasses for incandescent gas-lamps." April 11.

Leeds Corporation Gas Works.—The Gas Committee of the Leeds Corporation has resolved to advertise for a manager for their New Wortley Works, at a salary of £300 a year.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Gas-Ovens for Disinfecting Purposes.

Sir,—We have read with interest the "Note" on the subject of "Gas-Ovens for Disinfecting Books," in the "Journal" for the 7th inst. You refer to the fact that high-pressure steam, while efficacious from a sanitary standpoint, has the unfortunate disadvantage of destroying the bindings of books; and you ask the question whether a gas-oven would not prove efficacious. In answer to that inquiry, we believe the following statement of facts will interest your readers: Six months ago, we constructed, for use in a workhouse, a large gas-oven, the special purpose of which was the disinfection of clothing. This oven was subjected to careful tests by the officials, and found to be thoroughly efficient for disinfecting purposes. It was also tested by the Visiting Inspector of the Local Government Board, who was perfectly satisfied with its efficiency.

One great advantage possessed by the gas-oven is that there is not the slightest risk of clothing being singed; but this frequently occurs when steam is used. As the disinfecting ovens are only employed for a short time each day, there is also a considerable economy in the use of gas, as is always the case where occasional heating is required.

April 13, 1896. R. & A. Main.

Labour-Saving Machinery for Gas-Works.—About a year ago the New Conveyor Company, Limited, and Messrs. Little and Graham, Limited, acquired the engineering works of Messrs. Stone Bros. and Co., of Smethwick, Birmingham; and all the workshops are now in full operation, equipped with modern tools, a number of which were designed specially for the production of labour-saving machinery for gas-works.

Water-Works for Ellesmere.—Colonel Langton Coke, M.Inst.C.E., recently sat at the Town Hall, Ellesmere, to hear an application from the Urban District Council to borrow £4000 for works of water supply. Mr. Stock, the Engineer, explained that it was proposed to take the water from the Liverpool Corporation mains by an 8-inch pipe. The estimated cost, without a reservoir, was about £2948. Mr. Hood said he had no objection to the general scheme; but he thought a 6-inch pipe would be sufficiently large. Mr. Stock said he wrote to the Urban Council on Nov. 9, 1895, stating that Mr. Parry, the Liverpool Water Engineer, said the head of the main drain was about 500 feet above the outfall, which would give considerable pressure, and mentioned the use of a 6-inch pipe. He stated to the Council that, having regard to the long life of a properly-coated cast-iron pipe, and the increasing demand, together with soft water causing the pipes to corrode, he suggested it would be best to have an 8-inch pipe; and this suggestion, after consideration, the Council adopted.

Monte Video Water Company, Limited.—The ordinary general meeting of this Company was held last Thursday week, at the London Offices, Moorgate Street, E.C.—Mr. F. S. Isaac in the chair. The Secretary (Mr. J. Anderson) having read the notice convening the meeting, the report and accounts for the past year, an abstract of which appeared in the "Journal" last week, were presented. The Chairman, in moving their adoption, remarked that they gave the proprietors so just an idea of the position of the undertaking, that no lengthy observations were required from him. He pointed out that there had been a small decrease in the gross revenue, and a larger one in the net income (£45,100, as against £46,700). The expenditure had been materially augmented by the difficulties connected with the abnormally excessive rainfall of the past year, which had considerably raised the filtration charges. The number of services continues to increase; those in operation at the close of last year amounting to 10,418, as against 10,338 in the previous year. The staff had worked well; and thanks were due to them for the earnest manner in which they had conducted the affairs of the Company. The motion was carried unanimously; and the dividend recommended was declared. Votes of thanks were passed to the Manager (Mr. Galwey), the Engineer (Mr. Kirkwood), and the Secretary and staff.

Gas, Water, and General Investment Trust, Limited.—The ordinary general meeting of this Trust was held at Winchester House, E.C., last Wednesday—Mr. Thomas Salt in the chair. He remarked that some three years ago he expressed the belief that, if their securities were sold, they would realize more than the nominal amount at which they stood in the books. In that hope, unfortunately, they had been disappointed. A large number of old ascertained losses had been written off. The total sum at the date of closing the accounts was £77,956; and it was quite possible that the suspense account for adjusting the value of securities would at the end of the current year show a larger debit than at the present time. On the other hand, if they were able to carry out certain matters which they now had in hand in the way they expected, the position might be very much improved. The uncalled liability on shares held by the Trust amounted to £40,245, as compared with £38,000 in the previous year. He did not pretend to say the accounts were satisfactory; but he thought the shareholders had no reason to complain of their investments, as the Company had paid an average dividend during seven years on the deferred stock of £5 18s. 7d. per cent. per annum. On the present occasion the Board recommended the payment of a final dividend on the preferred and deferred stocks, making 4½ and 3 per cent. respectively for 1895; and so far as they could judge, the Company were in a better position now than they were last year to earn the same dividends. Their 292 securities stood in the balance-sheet at £989,968. Of this amount, £113,000 was invested in water companies, and £265,000 in gas and electric light companies. After giving particulars as to the Company's investments, the Chairman moved the adoption of the report. Mr. J. B. Braithwaite seconded the motion; and it was agreed to. An extraordinary general meeting was afterwards held, at which a resolution was passed exempting the investments of the Trust in the Salt Lake and Ogden Gas and Electric Light Company from the limit imposed by the Articles of Association.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

Tuesday, April 14.

EAST LONDON WATER (HEIGHT OF SUPPLY) BILL.

On the order for the second reading of this Bill, the object of which was to require the East London Water Company "to provide and keep the supply of water constantly laid on at such a pressure as will make the water reach the top storey of the highest houses within the limits of supply included in the Administrative County of London,"

Mr. PICKERSGILL said the sanitary officers of East London bore testimony to the mischief against which the Bill was directed; and the widespread interest which was taken in the question was shown by the fact that almost every local authority had urged the London County Council to remedy the existing evil. The reason for the East London Water Company being singled out was because they had a lower statutory obligation imposed upon them, in regard to the pressure of their supply, than any other Metropolitan Water Company. The general law was that every water company should be required to provide such pressure as would supply water to the top floors of the highest building in the district; but by the Private Act of that Company, which was obtained in 1853, it was prescribed that the statutory height of the pressure should be only 40 feet above the pavement. The New River Company, which practically supplied the same district as the East London Company, had a statutory obligation to provide a pressure of 70 feet. His name appeared first on the back of the Bill. The Vestry of Bethnal Green asked him if he would be willing to back a Bill about to be introduced by the London County Council dealing with the height of supply of the East London Water Company. Knowing the vital interest of his constituents in the matter, he gave his consent. He received no communication from the Council; and he was not consulted in drawing up the Bill. But even if the form of the Bill were better—even if it were less controversial—he could not ask the House to read it a second time in face of the extraordinary fact that, although the Bill was promoted by the Council, and although the Parliamentary Committee of the Council had approved it, and instructed their Agent to introduce it, yet not a single member of the Council who was also a member of Parliament was willing to back it. He did not think the House and those members whose names were on the back of the Bill had been treated with proper respect. In these circumstances, it was inevitable that the Bill should be withdrawn. A good cause would be prejudiced by going to a division, for he believed there was urgent need for a regulating Bill in this matter. The House, by its recent action, had indefinitely postponed the purchase policy; and there was a fair and open field for that policy of regulation to which a large section of the County Council were willing to agree. If the second reading had not been formally moved, he should have wished to move for the discharge of the order and the withdrawal of the Bill.

Colonel LOCKWOOD complained of the action of the hon. member in withdrawing the Bill, and at the same time making a violent *ex parte* statement against the East London Water Company. That Company had, he said, done their best to meet the requirements of the County Council in regard to the supply to the poor districts in the East-end.

Mr. H. SAMUEL said his name was also on the back of the Bill; and he joined in the protest which had been made against the treatment he and those who were acting with him in this matter had been subjected to by the County Council.

The motion for the second reading was negatived; and the order was discharged and the Bill withdrawn.

The following progress was made with Bills last week:—

Bills read a second time and committed: Cowes Gas Bill, Falkirk and District Water Bill.

Bill reported: Cheltenham Gas Bill.

Bills read the third time and passed: Colwyn Bay and District Gas Bill, Fylde Water Bill, Guildford Gas Bill, Ilfracombe Gas Bill.

Bills withdrawn: Boards of Conciliation Bill, East London Water (Height of Supply) Bill.

HOUSE OF COMMONS COMMITTEE.

Thursday, March 26.

(*Before Sir* W. CODDINGTON, *Chairman; Sir* L. LYELL, *Viscount* WEYMOUTH, *and Mr.* JOHNSON-FERGUSON.)

MATLOCK BATH GAS BILL.

The proceedings on the above-named Bill, which is to provide for the transfer to the Matlock Bath and Scarthin Nick Urban District Council of the undertaking of the Matlock Bath Gas Company, and to authorize the Council to supply gas within their own district as well as in Cromford, Bonsall, and part of Matlock, and to raise the necessary capital, were opened to-day. The scheme was opposed by the Gas Company immediately concerned, by the Matlock Bridge Gas Company, and by the Matlock District Council.

Mr. BALFOUR BROWNE, Q.C., Mr. CLAUDE BAGGALLAY, and Mr. RAM appeared for the promoters; Mr. LITTLER, Q.C., Mr. PEMBER, Q.C., and Mr. COWARD, for the Matlock Bath Gas Company; Mr. RICKARDS, for the Matlock Bridge Gas Company; and Mr. PEMBROKE STEPHENS, Q.C., and Mr. SHAW, for the Matlock District Council.

Mr. BALFOUR BROWNE, in opening the case, said the Bill had been promoted by the Urban District Council of Matlock Bath to enable them to purchase an undertaking supplying gas partly in the district of Matlock Bath and partly outside. The Company whose works the Council were seeking to purchase was a non-statutory one; and they had no right to break up streets and roads. They could make dividends of 100 per cent., if they were able; and they could divide them. They were not bound to supply gas of a certain illuminating power; nor were they under any obligation with regard to its purity. A statutory Company, on the other hand, was both regulated and protected by Parliament. They had power to do all these things; but they were put under certain restrictions, both as to dividends and as to the quality of the gas. In the supply of gas, the concession granted by Parliament to any company was not to endure for all time. If it could be shown that a company had failed to do their duty to the public, Parliament had, on more than one occasion, revoked the concession it had granted. Local authorities had come to Parliament with Bills for the acquisition of undertakings; and their applications had been acceded to when it was considered that the transfer would be to the public interest. [The learned Counsel cited precedents in support of his statement.] In the present case, the undertaking sought to be acquired was the property of a non-statutory Company; and, if the Council pleased, they could, under the powers conferred by the Public Health Act, compete with and ruin the Company.* But he did not think that would be fair; nor did he believe Parliament would allow any such course to be pursued. Instead of proposing to ruin them, the Council came forward fairly and honourably to buy their undertaking for what it was worth. The Local Authority were practically unanimous in thinking the time had come when the Gas Company should be moved out of the way, and the supply of gas placed in the hands of the Council. Probably the Committee would be told that the Company were unwilling sellers. But he would read one or two of their own letters, which would show that they had contemplated this purchase. The struggle between the Company and the Council would really be on the question as to what was to be paid for the undertaking; and he should ask the Committee to decide, in the interests of the public, that his clients were not called upon to give more for it than a fair and reasonable price. If the Company obtained that, he did not think they would have anything to complain of. The negotiations for the sale of their property by the Company opened in the year 1892. At that time, the Local Board (now the District Council) asked the Company if they were willing to negotiate for a sale. On the 1st of March, 1893, there was on the Company's *agenda* an item to the effect that the application from the Local Board in regard to the purchase of the works was to be considered. This showed that at that time the Company had under their notice his clients' request. On March 2, the Company wrote that the matter had been brought before the shareholders; and that it had been decided that, if the Local Board made such an offer for the works, &c., as the Directors regarded as satisfactory, they had been instructed to lay it before the proprietors. He relied upon the first letter to show that the Company were not unwilling sellers, and that it was merely a question of price. Subsequently inquiries were instituted into the matter of a suggested amalgamation of the two districts of Matlock and Matlock Bath; and the negotiations with the Company were for a time suspended. But when these inquiries came to an end, the negotiations were resumed. He had a letter dated May 11, 1895, written by the Secretary of the Company to the Clerk of the Matlock Bath Urban District Council, in which he acknowledged a letter of the 6th of that month, asking what would be the terms on which the Company would be willing to give the Council the option of purchasing their undertakng; and it went on to say that the Council's letter should be laid before the Directors at their next meeting. This, the Committee would see, showed a perfect willingness to sell. The Company were prepared to incur the expense of calling the shareholders together, if the Council were in a position to buy. In order to put themselves in that position, they promoted the Bill before the Committee; and if this were passed, the Council would be able to purchase the gas-works, either on terms to be agreed upon between themselves and the Company, or, failing agreement, upon others to be settled by arbitration. Surely nothing could be fairer than that. They wrote on the 11th of September informing the Company that it was their intention to promote a Bill unless terms for sale and purchase could be mutually arranged by the middle of October. In reply, the Secretary said his Directors had held a special meeting to consider the letter; and he was instructed to say that they did not feel that the expense of calling the shareholders together should be incurred unless the Council had some definite proposal to lay before them, or were in earnest, and not only in earnest, but in a position to purchase the undertaking. That was on the 26th of September. On the 8th of January, the Council offered the Company £11,500; and on the 13th, the Company wrote to say they were not disposed to sell—adding that they were applying for a Provisional Order to confer upon them statutory powers. This Order would have precisely the same effect as in the Whittington case recently before the Committee [*ante*, p. 814]—it would enhance the value of the undertaking. In order to promote their Bill, the Council had to obtain the sanction of the ratepayers, and a poll was taken; 362 votes being given in favour of the proposal, and 157 against it. The Bill was therefore approved in the district by at least two to one. He would now deal with the history of the Company. It was formed, under a deed of settlement, in 1853; the origina capital being £2000. This appeared to have been increased to £4500; and this was the whole of the amount of subscribed capital on their balance-sheet up to a recent date. A later balance-sheet, however, showed the capital at £10,000. Of the difference, £1000 had been raised by shares; and he would explain what had been done to raise the remainder. A circular had been sent out in June, 1895, stating that the works had been valued at £9000, and that it had been decided to transfer the difference between the £4500 and the £10,000 to the share capital; this difference being granted in shares to the existing holders by way of bonus. At that time, however, there was no money at the bank; and therefore the bonus was worth nothing. The valuation referred to in the circular was made upon the Company's balance-

* At the time this statement was made, the result of Lieut.-Col. Addison's inquiry in regard to the Company's application for a Provisional Order, mentioned in the "JOURNAL" last week, had not been announced.—ED. J.G.L.

sheet for Dec. 31, 1894, which showed that the total expenditure had been £6404. He thought, therefore, that the policy of the Company in doubling their capital was quite obvious. They wished to sell their works; but they wished also to compel the Local Authority to pay a considerable price for them. There were other points to which he would invite the attention of the Committee. The site of the works was not good, being on the side of a hill. It was close to a railway station, and yet the Company had no siding. The Council proposed, if they succeeded in getting the undertaking into their own hands, to have a new site in a much better position. It would be close to two railways, where they could have a siding made, and also near a canal, which would facilitate the transit of coal. According to their Provisional Order, the Company said they were quite willing to sell all their works in the area of the Matlock District Council, and also the works in the districts of the Cromford and Bonsall Councils; but yet they professed to be unwilling to sell to the Matlock Bath Council. They were prepared to sell to the other authorities at such price and upon such terms and conditions as should be fixed by arbitration under the Lands Clauses Act; and that was exactly what his clients offered. They were also willing to sell to the Matlock District Gas Company. It might be said that the Matlock Bath Council were purchasing works outside their own area; and that what was good for them, ought to be good for the other districts, who should be invited to have their own works. He was not going to gainsay that; and it would be found, by clause 28, that provision was made by which any of the outside districts might become the owners of their works. The Bill proposed that the Council should supply gas at a certain price. The figure in the Company's Provisional Order was 4s. per 1000 cubic feet for gas of 15-candle power; the Council's figure was the same for 18-candle gas. There were only two other matters which required explanation; the first of them being unopposed. The Council had had a serious litigation with the Derbyshire County Council as to certain main roads, under section 11 of the Local Government Act of 1888. The Council had been successful in every instance up to the present time, and had had their costs. The matter, however, was still pending in the House of Lords; and they sought power, in case they should have to pay the costs, to borrow the amount, and spread it over a certain time. There was one other point—as to a certain adjustment which should take place for a payment of £20 a year, under an old Act of Parliament, to the Matlock District Council towards the repair of certain roads. The points of the Bill were therefore shortly these: The purchase of the undertaking of the Gas Company; the alteration of the site of the works; provision for covering the costs of the litigation with the Derbyshire County Council; and the re-adjustment of the payment of £20 per annum in respect of road repairs. He now came to the petitions against it; and these he would, with the Committee's permission, deal with on the following morning.

Friday, March 27.

On the re-assembling of the Committee this morning,

Mr. BALFOUR BROWNE addressed them on the petitions against the Bill. He took first that of the Matlock Bridge Gas Company. The Company, he said, supplied a small piece of the northern part of the Matlock Bath district; and they were afraid that the Council would invade their territory. But a clause would be inserted in the Bill providing that it should not be lawful for the Council to supply gas within the present limits of the Company. Some day, the Council might be able to take over this portion of the Company's district; but the proviso would protect them. The Matlock Bridge Council complained that the Matlock Bath Council would break up the roads; but the Council would only have the same powers as the Company in this respect. The Matlock Bridge Council opposed the clause relating to the erection of new works, because they would lose the rateable value of those works, which would go to Cromford. They also objected to the clause cancelling the payment to them of the £20 per annum. But that payment should, he contended, cease, as the roads were now maintained by the County Council. With regard to price, the Matlock Bath Company proposed 4s. as a standard; whereas the Council put in their Bill 4s. as a maximum, which was a very different thing. He concluded by assuring the Committee that the Provisional Order applied for by the Company was altogether unnecessary; and that if the Council's Bill were passed, the Order would never be heard of again.

The following evidence was then called for the promoters:—

Mr. *J. E. Lawton*, the Chairman of the District Council, said the sole object of the Bill was to enable them to obtain possession of the gas-works. At his own works, they paid from 30 to 33 per cent. more for a much worse article than his competitors in trade did. He did not suppose the gas was ever more than 15-candle power, whereas his competitors had 18-candle gas. Speaking for the Council and the district generally, he was of opinion that the purchase of the gas-works would conduce to the benefit of Matlock Bath; and it was the wish of a large majority of the ratepayers that the purchase should be effected.

In cross-examination, witness said the population of the district was 1900; and 517 of them voted at the poll on the gas question. He admitted that Matlock Bath was trying to extend itself by the Bill, the gas-works not being in the Council's district. He considered £11,500 a fair offer for the undertaking; and the new works were estimated to cost £8000. If they moved the works, the money spent on them—that was to say, so far as the old partners were concerned—would be wasted. The Bill would upset the settlement of the boundary between the two Gas Companies which was fixed by a Provisional Order granted in 1891; but the Council would give the Matlock Bridge Company all the compensation they could obtain by fair and open arbitration.

Mr. COWARD went through a series of figures to show that the profit made by the Matlock Bath Company was about £1000 per annum, and that the £11,500 proposed to be paid for the undertaking only represented ten years' purchase.

Witness, in answer to further questions, said the Company had treated their customers liberally, and the quality of the gas had been a little better since there had been change of management. It was, however, intermittent. Unquestionably the Bill was in the public interest. He represented a consumer taking 40 per cent. of the gas. It was by the advice of their Counsel that the District Council did not produce witnesses at the Board of Trade inquiry in connection with the Company's application for a Provisional Order.

By the CHAIRMAN: Without allowing for depreciation, the Company's profit might have been £1000 a year; but the depreciation must be deducted. The proprietors of Masson Mill had it under consideration to remove their works nearer Manchester, where gas was better.

Mr. *F. C. Lymn*, the Solicitor to the District Council, was then called; and he traced the various negotiations which had taken place between them and the Gas Company.

Monday, March 30.

On the resumption of the proceedings to-day,

Mr. *Lymn* was examined on the point that the Council had been refused copies of the Company's balance-sheets and permission to inspect their works. He stated that on Dec. 7 last he again wrote asking for reasonable facilities for their Engineer (Mr. E. H. Stevenson, M.Inst.C.E.) to obtain the necessary information for making an offer for the undertaking; and on the 18th, he received a letter to the effect that the Directors declined to grant the request. The Council then asked Mr. Stevenson what he would advise them to give; and on Jan. 18 last, he (witness) wrote on their behalf offering £11,500 for the concern.

Cross-examined by Mr. LITTLER, witness said the first letter was sent in May; but the first request to be allowed to inspect the works was made in October. It had then been decided to promote the Bill. He did not make himself acquainted with the history of the Company as Clerk to the District Council; but during the two years he was Secretary to the Company, he knew what was being done. He could not say there was a considerable amount of money spent out of revenue on the works while he was there; but it might have been so. He heard, at the recent Board of Trade inquiry, that a dividend could not be paid by the Company for two years, owing to expenditure out of revenue; and he had no doubt whatever as to its being true.

Mr. LITTLER pointed out that in 1886, in order to extend the mains and to provide public lamps and other things necessary, the Directors were obliged to apply income to this purpose; and inasmuch as the deed of settlement only authorized the Company to borrow £300, of which £265 had been expended, no dividend was declared. In 1888 an additional gasholder was built, one being inadequate, and an expenditure of £313 incurred. The Company gave bonds to the contractors for £250 payable in two years; and the balance was paid out of income.

In further cross-examination, Counsel drew witness's attention to the dividends declared, and asked him if he was not aware that the average for the whole time the Company had been in existence was not more than 6½ per cent. on the nominal capital. No reply was given to the question. On the subject of the charge for gas, he acknowledged that in ten years there had been a reduction of 1s. 3d. per 1000 cubic feet; but he said it was owing to the strong representations made by the consumers. The public did not know what was the Company's average dividend. He had no knowledge that the consumption of gas had increased from 5,428,000 cubic feet in 1884 to 15,330,000 cubic feet in 1895; but he was not surprised that this had taken place. With regard to the expenditure out of revenue, he did not dispute that up to the end of 1884 the Company had laid out £5023, whereas only £175 had been spent on capital account. Counsel took witness to the next year, and mentioned several items which he said were expenditure out of revenue which should properly have been charged to capital; but witness could not say anything as to this.

Mr. LITTLER: We are now getting to 1890. The total capital then was £5364; and if you look at the dividend paid—£216—it is a nominal 10 per cent., or only 8 per cent. on the amount expended?

Witness: It is 10 per cent., according to the balance-sheet.

Mr. LITTLER: Nominally, but really it is only 8 per cent. In 1891 you will find the share capital still at £4320; but with a further issue of unalloted shares, it reached £4500. But the expenditure up to December, 1890, was £5364; and with the expenditure in 1891, this was increased to £5735. This year, therefore, instead of 10 per cent., it was only 7·35 per cent. upon the real capital. In 1892, there were several small items I will not trouble you with. In 1893, the total expenditure was £5865, less depreciation £130 written off. Mr. Balfour Browne said there had been no allowance for depreciation. If you look at the dividend paid, you will see it is only on £4500 at 10 per cent., or 7·8 per cent. on the real expenditure. The next year there was only 7 per cent. paid on the actual expenditure.

Mr. RAM pointed out that the witness was not saying anything; and he asked that all this should not be taken as evidence, but as an ordinary statement by Mr. Littler.

The CHAIRMAN said it was clear that considerable sums had been expended out of revenue on capital account for a series of years.

Cross-examination continued: The Council required £21,500 in connection with this project—£11,500 for the present works, and £10,000 to be expended when necessary. They intended to remove to a new site. In the Bill, they put fifty years as the period for the repayment of the loan; but the Lord Chairman had reduced it to forty years. They borrowed their last money at 3¼ per cent.; but he would leave the Engineer to say whether or not, if they obtained the new loan at 3 per cent., it would cost them £970 per annum.

Mr. LITTLER: That is a thing a Clerk ought to know. If the income of this concern was only between £800 and £900 per annum, and you had to pay even £900 a year interest, do you think your ratepayers would consider that a good and satisfactory investment?

Witness: I do not know what we shall have to pay.

I am putting it on your own figures. I shall tell the Committee you will have to pay double this amount. Have you ever been told that for a well-conducted company you have to pay 28½ years' purchase, and for compulsory sale something upon that?—That would be for a statutory company.

No; for a non-statutory company. Supposing this purchase, instead of costing you £11,500, cost you double or nearly treble that, do you think your ratepayers would want it?—If it would produce an income to pay for it.

But on £800 income a year?—The income will increase accordingly.

In further cross-examination, witness said he heard it emphatically stated at the recent inquiry that, with the exception of minor complaints, which all gas companies had, none had been made as to the Matlock Bath Gas Company. Notwithstanding that statement, the Council did not call any evidence to contradict it, although the object of holding the inquiry was that witnesses might be examined on the spot. Their reason for taking this course was that they were coming to Parliament. Questioned as to certain documents and tables that were handed in on that occasion, witness declared that, if they were passed to the Inspector, the representatives of the Council did not get them. He admitted that, in the course of the evidence, he heard that Mr. J. F. Bell had valued the Company's works at £9000; but he could not say that Mr. Derbyshire had stated that £2495 more had been spent upon the works than was represented by that valuation. He did not know, of his own knowledge, that upwards of £3000 more had been spent since 1887.

Mr. LITTLER read portions of the evidence taken at the inquiry, and the speeches made; and he quoted a remark of Mr. Ram to the Inspector to the effect that the Company's capital had been "watered." This was, he said, in regard to the bonus that was issued to the shareholders on the advice of Mr. Derbyshire, increasing the capital from £4500 to £10,000. Counsel laid great stress upon the fact that the Inspector, notwithstanding what Mr. Ram had said, stated that Mr. Derbyshire had given his evidence perfectly fairly, and had told him without reserve all that had taken place.

Witness admitted that he heard the Inspector make that remark; and the Council did not venture to call anyone to rebut the evidence.

Was it not said that, with the exception of three of the largest works—Derby, Buxton, and Ilkeston—the Matlock Bath Company charge the lowest price for gas in Derbyshire?—Yes; it was said.

And that is true, is it not?—That I cannot say. I have not verified it. The Matlock Bridge Gas Company charge 3s. 9d., I think; but they have a much larger capital.

I have never understood that a company with a much larger capital charge a higher price. I have always understood it was the opposite?—The Matlock Bridge Company are not confined to the district of the Urban District Council.

The CHAIRMAN asked Mr. Littler what reason there was to labour the question of the value of the undertaking. As a matter of fact, the Committee had not to decide upon its value.

Mr. LITTLER replied that, having regard to the price they charged for gas, and to the fact that theirs was a property which would develop, they did not wish to run the risk of arbitration. If people had property which they dealt with properly, he had yet to learn that they should be compelled to sell it. They had to run the risk of an arbitrator who could not know as well as they did themselves the value of their property.

The CHAIRMAN: We are quite satisfied that the Company have spent on the works a considerable amount of money out of revenue.

Cross-examined by Mr. RICKARDS: When the Matlock Bridge Gas Company obtained their Order in 1891, he wrote to the Company and the Board of Trade objecting. But these objections did not in any way apply to the boundary of the district of the Company. The districts were the subject of an arrangement between the two Companies. In the portion of the Matlock Bath district that was supplied with gas by the Matlock Bridge Company, he had received no complaints whatever. In their Order of 1891, the Bridge Company were entitled to charge a standard price of 4s. 3d.; but he thought they had been for some time charging 3s. 9d., or 6d. less than the standard. He did not know that for two years during which they had been charging this reduced rate, they had not been earning their full dividend, as, though he had had the balance-sheets officially, he had not examined them.

Re-examined by Mr. RAM, witness said the first letter that started all this business was one from the Matlock Bath Gas Company, dated Sept. 26, 1894, asking the District Council to make them an offer. This was why they wished to examine the accounts and inspect the works. It was not because they had a Bill that they asked this privilege. As to the several payments out of revenue for new works, he heard of these matters first at the inquiry, and had no means of ascertaining what expenditure had been made for these purposes. It had been suggested that the Company's average dividend had been 6¼ per cent. They had been paying 10 per cent. for several years, according to the balance-sheets, on the capital subscribed. The last dividend declared was 10 per cent. on the augmented capital, which was equivalent to 20 per cent. on the nominal capital of £4500 appearing on the accounts at the end of 1894. Referring to the balance-sheets, Counsel put it to witness if it was not a fact that, according to the sums apparently expended in dividends, it worked out to 12 instead of 5 per cent. for 1884—the same thing occurring in the three following years.

Mr. LITTLER (interposing) said his friend was assuming what was absolutely inaccurate. He was estimating the dividend by all the profits shown on the balance-sheet as possible of division. That was what the Company might have paid, not what they actually did pay.

The CHAIRMAN intimated that the Committee could not accept Mr. Ram's interpretation of the 12 per cent.

Mr. RAM: We are altogether in the dark.

The CHAIRMAN: I cannot admit that. I think the accounts are very badly drawn up; but, by going carefully through them, one can see what they mean.

The Rev. *E. Hacking*, the Vicar of Cromford, said the church, the vicarage, and the schools were supplied with the Matlock Bath Company's gas, the quality of which was not generally good; and he had made complaints to the collectors. In his opinion, the gas-works in their present position were unsightly, and spoilt a pretty picture. If they were placed below the church at Cromford, people would not see them so much.

Cross-examined: He knew nothing about the candle power of gas; he compared it with that supplied at Derby, Accrington, and Manchester. Witness was questioned a great deal on the subject of his gas-stove meter being defective; but his recollection on this matter was rather at fault. This called from Counsel a remark to the effect that it was hard that witness should be brought up against the Company, and then be able to remember so little.

Mr. *R. Webster*, the Manager of the Masson Cotton Mills, the property of the Arkwright Company, said a great deal of gas was employed there for singeing the fibre projected from the thread. For many years, they had complained, both verbally and in writing, of the quality and quantity of the gas; and had actually been compelled to stop their machinery on account of the short supply. Witness gave details of complaints back to Dec. 12, 1890; but he admitted that they all arose in the winter time, and that the Directors of the Company had offered to put down a larger main to the mills. The complaint as to quality was that the gas when burning had a yellowish tinge, and gave off an offensive smell. This year they had complained as many as three times in one week; there was always some fault or accident. It was essential that the supply of gas to the mill should be continuous; but one day last November, all the lights (about 1000) went out, and could not be restored for two or three hours. This caused a loss to the firm, and was moreover dangerous to the workpeople.

A few questions were put to the witness in cross-examination; and the further proceedings were adjourned till after the Easter holidays.

The inquiry was resumed last Tuesday, when further evidence was given on behalf of the promoters; one of the witnesses being Mr. E. H. Stevenson, M.Inst.C.E. During his examination, the Committee-room became so dark, owing to the murkiness of the outside atmosphere, and the absence of means of artificial illumination, that the proceedings had to be adjourned till the following morning. On the reassembling of the Committee on Wednesday, Mr. Stevenson's evidence was continued. He expressed the opinion that it would be an absolute benefit to the district to possess the gas-works; and he repudiated the idea that the acquisition of the undertaking would be an intolerable burden in the district. The water-works, on which £5700 had been borrowed, were now, he said, a paying concern. The District Council had authority to spend £9000 on sewerage; and the balance of the borrowing powers, which amounted to £19,000, might be applied to the purchase of the gas-works. Mr. Stevenson was followed by Mr. W. R. Chester, M.Inst.C.E., who said the present site of the works was unsuitable; and they ought to be taken entirely away from it, in the interests of Matlock Bath as a health resort. The proposed site was admirably adapted for the manufacture and supply of gas to the district. Mr. Pembroke Stephens then addressed the Committee on behalf of the Matlock Bridge District Council; contending that the Bath and Bridge Councils stood on exactly the same legal footing, with this exception, that the works which were the subject of the present inquiry were situate in the Bridge Council's district. It was not alleged that there had been any complaints respecting the gas supply—such as districts being left in darkness—or anything which warranted the promotion of the Bill by an ambitious little place like Matlock Bath. He submitted that the object of the Bill was to get hold of an outside district for purposes of taxation. The Bill was unjustifiable, and weak in regard to finance; and the poll of the district showed the opposition of one-third of the inhabitants. The proceedings were adjourned to the following Monday (yesterday). A further report of the portion of the inquiry above summarized will appear next week.

The Board of Trade and the Dee Sluices Bill.—The Board of Trade have examined the Dee Sluices Bill promoted by the Chester Town Council, which, as reported in the "JOURNAL" last week, is opposed by the Chester Water Company. The Board condemn the proposals in the Bill as being likely to interfere with the salmon fisheries of the river, and because the full effect of the projected works cannot be properly considered unless regard is had to the facts connected with the discharge of the sewage of Chester into the stream. The Board "refrain from suggesting any amendments of the Bill, as it appears to them that no modifications as regards the proposed works could sufficiently protect the public interests under their supervision from the serious injury with which they are threatened. Such an opposition as this, from a Government Department, practically means the collapse of the proposed scheme.

The Water Supply of Yelverton.—The Water Committee of the Plymouth Corporation have had under consideration the question of the charges to be made to consumers in Yelverton, a district to which a new supply is being furnished. The cost of the works required to furnish the supply is about £3200; and the annual charge for interest, sinking fund, maintenance, repairs, and collection, will be about £180. As the Corporation have decided that no loss must be entailed in connection with the supply, the Committee recommend that the water-rent be at the rate of 7½ per cent. on the rental value of the property supplied, but that consumers who apply for a supply before the end of the present year be charged at the rate of 5 per cent. for a period of three years. Service-pipes are to be laid to the boundary of the property at the expense of the Corporation, if application is made this year; but afterwards the owners are to bear the cost.

The Water Supply of South Brent.—A new water supply for the town of South Brent, one of the health resorts on the southern slope of Dartmoor, has lately been inaugurated. The question of water supply has been the subject of local controversy for many years; but, thanks mainly to the perseverance of Mr. J. R. T. Kingwell, the Chairman of the District Council, the opposition has been overcome, and the scheme is now satisfactorily carried out. The source of the new supply is at Gingaford, two miles from the town; and a gauging taken by Mr. C. G. S. Acock, the Surveyor, showed that the yield is equal to 80 gallons per head per day. This is in addition to the old supply; so that there is promise of an abundant service for a very much larger population that at present exists. A 4-inch main brings the water into the town; and as the new supply is directly connected with the old mains, there is now a bountiful service of water to the houses on the higher levels, which were previously only sparsely supplied. The water has been analyzed with satisfactory results. The District Council were fortunate in being able to conclude an arrangement with the owners of the land on which the springs rise; and the work has been efficiently carried out by Messrs. R. Veale and Son, at a cost of £670.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Saturday, April 18.

(*Before Mr. Justice* WILLS.)

Incandescent Gas-Light Company, Limited, v. De Mare Incandescent Gas-Light System, Limited, and Others.

Same v. Sunlight Incandescent Gas-Lamp Company, Limited, and Others.

To-day the reserved judgments were delivered in the above actions, the trial of which occupied his Lordship almost continuously from the 9th ult. to the 1st inst., as reported in previous issues of the "JOURNAL."

The following was the judgment in the De Mare case:—

The plaintiffs complain of threatened infringements by the defendants of letters patent granted to Carl Auer von Welsbach for the manufacture of an illuminant appliance for gas and other burners, being No. 15,286 of 1885. The defendants deny that what they propose to do would constitute an infringement of the patent; and they attack the patent on nearly all possible grounds. It had long been known that certain substances, notably lime, magnesia, and zirconia, when subjected to the heat of a flame of mixed coal gas and air will produce a brilliant incandescence. The common oxy-hydrogen lime-light was well known; zirconia has been used on a very small scale in the same way; and the illuminant properties of magnesia were also well known. Many attempts have been made to utilize these properties by introducing such substances into a flame of gas, or gas and air mixed; but they have all, for one reason or another, come to nothing. I am not going to enter at present into questions of anticipation; but it is quite safe to say that, for all practical purposes, Welsbach discovered a practical and simple method of arranging the oxides to be rendered incandescent in a shape which made it possible to use them in burners, and also discovered that the class of substances which, for convenience and brevity, are generally spoken of by chemists as, and throughout this case have been called, "rare earths," would, when blended with zirconium, afford at once the necessary illumination and the necessary coherence. "Earth," in the specification, is used—and it appears to be the general practice of chemists to use it—in reference to the substances with which this patent is concerned, as a synonym for the oxide of the metallic base, or the metallic bases, and, in names of substances which end in "a," to designate the oxides of the corresponding metals whose names end in "um." Thus zirconia is oxide of zirconium; lanthana, oxide of lanthanum, and so on. It is perhaps an elementary thing to mention; but I have found out during this case, that even men of science do not always use these terms correctly. Even so great an authority as Professor Cruickshank, in one passage of his work which has been much cited, used the name of the oxide in correlation with the name of the metal, where it is clear that he means to compare either the two metals or the two oxides; and Sir Henry Roscoe told us towards the end of the case that chemists have almost an inveterate trick of failing to distinguish between the oxides and the metallic bases. No doubt it does not mislead them; but it is apt to be confusing to an outsider like myself; and I thought it well to mention it. One other matter had better be referred to before I proceed to discuss the specification. There is a group of metals whose oxides or rare earths are known to chemists as the cerium group. This group is divided into the cerium and yttrium sub-groups. They contain many—indeed, most—properties in common. But they are distinguished by one marked line of division very convenient to the chemist; and while the cerium sub-group, when in solution, is precipitated by a potassium sulphite, the salts of the yttrium sub-group are not so precipitated, so that there is no difficulty in separating the two sub-groups. The different members of each sub-group can only be separated by a very elaborate and troublesome process known as fractional precipitation; and the members of the yttrium sub-group are particularly difficult to disentangle. The cerium sub-group of metals consist of cerium, lanthanum, didymium, and samarium, and perhaps a fifth. The latter is separated from didymium in very small quantities, and need not be further noticed. The yttrium sub-group consists of yttrium (which has been known for a century) and erbium (which has been known for nearly a century), ytterbium, and a number of others, which, as is said by Ditmar, in an article in the "Encyclopædia Britannica," seem to grow like the minor planets. They are exceedingly alike in properties and behaviour, and are, except yttrium, very difficult to isolate; and for practical purposes they cannot be separated when found together. The members of both sub-groups are frequently found together as in a mineral called gadolinite, one of the principal sources whence they are extracted. So that the power of easy separation by potassium sulphate which divides them at once, on precipitation, from the cerium sub-group is important. The members of each sub-group are very often found together. Few members of either sub-group are found without traces of other minerals either of the same or of other sub-groups. But this case is not concerned with traces, which need not be further alluded to. Zirconium is obtained from a mineral called samarskite, which contains various metals of the cerium sub-group. Cerite is a mineral which contains cerium, didymium, and lanthanum, but none of the members of the yttrium sub-group. There are other minerals which contain both cerium and zirconium, or combinations of the respective metals of both sub-groups, in great variety. In all cases, the minerals from which the rare metals or their oxides are extracted have first to be freed from certain grosser impurities, such as silicon, oxide of iron, and the like. That having been done, the two sub-groups are easily separated by the potassium sulphate precipitate above prescribed. The only other separation which need be considered is in respect to the cerium sub-group, whence, according to the patentee, the bulk of the cerium and the whole, or practically the whole, of the didymium must be extracted. I have used the present tense perhaps inaccurately, as I am speaking of what was known at the date of the patent. Since then, in consequence of Welsbach's patent, a great industry in the production of the salts of the rare metals in question has sprung up, and a great deal more is known about them than was then known. But Professor Crookes had, in 1883 and 1885, delivered two lectures on them at the Royal Society, which had been published, and which contained the results of great research on their nature in connection with one another and on the means of separation. If I were to change the names of the metals into those of the oxides, and substitute zirconia for zirconium and yttria for yttrium, and the like, my statement would be equally correct. The patentee has coined one phrase which apparently is not to be found in the books. He speaks of "ytterite earth." Cerite earth appears to have been a common name enough; but I am informed that ytterite earth is not a phrase in general use. It is, I think, beyond all doubt that he uses it in a sense precisely analogous to that in which the words "cerite earth" are commonly used—that is, not for the natural minerals containing yttrium and its associated metal, but for the composite oxides of yttrium and other members of the yttrium sub-group, after that first process of separating them from the impurities of silicon, iron, and the like had been performed.

With these preliminary remarks, I will proceed to ascertain what the meaning of the specification is. I have been referred to the various supposed rules for the construction of a specification; but I have not derived the slightest assistance from them. Such as have been suggested appear to me either too obvious to need enunciation, or to require so much qualification as to be apt to mislead. I am not greatly helped, I confess, by being told that it is the duty of the Court fairly and truly to construe a specification—neither favouring one side nor the other, neither putting an unfair gloss on the specification to save the patent if it is said the patent is void, nor putting an unfair gloss upon it to make it include something which you may think it is unhandsome to take from the patentee—even although this proposition is to be found in a reported case in the House of Lords. A specification, like any other instrument, must be construed as one best can construe it, by trying to see, not so much what the draftsman meant (commonly his desire is to be as vague as possible without endangering the patent), but what he said; and it is only by a critical examination of the specification, illustrated by the common knowledge existing at the date of the patent, that one can arrive safely at its construction. Welsbach heads his patent, "The manufacture of illuminant appliances for gas and other burners." "My invention," he says, "relates to manufacturing an illuminant appliance in the form of a cap or hood, to be rendered incandescent in gas or other burners so as to enhance their illuminating power"—that is, so as to enhance the power of illumination already possessed by the burners. "For this purpose," he continues, "I employ a compound of oxide of lanthanum and zirconium"—he means, obviously, a compound of the oxides of lanthanum and zirconium, or of these with oxide of yttrium, "which substances, in a finely-divided condition, when they are heated by a flame give out a large, pure, almost white light without becoming volatilized, or producing scale or ash, even after being kept incandescent for many hours, but remain efficient without deterioration even when they are long exposed to the air." He then proceeds to give what I may call specimen prescriptions for blends, with which it will, I think, be more convenient to deal presently. Having said this, he proceeds: "For applying the substances mentioned as an illuminant, I use a fine fabric, preferably of cotton, of suitable pattern, previously cleansed by washing with hydrochloric acid. I saturate this fabric with an aqueous solution of nitrate or acetate of the oxides"—that is, the oxides already mentioned in the opening sentences of the specification, which I have called the "prescriptions"—"and gently press it until it does not yield fluid, so that, in stretching or opening out the fabric, the fluid does not fill up its meshes. The fabric is then exposed to ammonia gas, and, when it has been dried, is cut into strips and folded into plaits." A method is then described of giving the desired shape to the cap or hood, and suspending it in the chimney of a lamp, which it is not necessary to discuss. "On igniting the flame," he continues, "the fabric"—that is, the cotton groundwork on which the oxides have been deposited—"is quickly reduced to ashes, and the residual earthy matters nevertheless retain the form of a cap or hood." He then says for part of the zirconia a mixture of magnesia and zirconia may be employed. Obviously, fabrics of various forms or constructions can be made according to the character of the burner to which they are applied. Then follows a paragraph relating to the means of strengthening the resulting structure, which is not material. The patentee then claims "the manufacture, substantially as herein described, of an illuminant appliance for gas or other burners, consisting of a cap or hood made of fabric, impregnated with the substances mentioned, and treated as set forth." I have passed over what I have called the "prescriptions," because I wish to present in the simplest form the outline of the process adopted, which begins by taking a fabric made (say) of cotton, impregnating it with the salts of the blends of the oxides in question, and then ammoniating it. The result of the soaking is to get the salts into the very minutest portion of the fibres of the fabric, so that, when finally the cotton fabric itself is eliminated by fire, there may be left a solid substance occupying almost the very portions of space now filled by the impregnated fabric. The result of ammoniation is to convert the salts into hydrated oxides, filling, as did the salts, the innermost recesses of every portion of the fabric. The fabric is not yet fit for permanent use in the burner; but the last operation is performed when the hood is placed in the burner, and set on fire by lighting the gas. This process drives off all the water of the hydrated oxides, and reduces them to their final condition of anhydrous oxides, in which state they perform the business purpose of giving illumination by incandescence. This seems to me to be so far the essence of Welsbach's process. I now come to the "prescriptions." "The proportions in which the substances"—that is, the substances which had already been mentioned, being the oxides of lanthanum, zirconium, and yttrium—"are compounded may be varied within certain limits. I have found the following proportions very suitable: 60 per cent. of zirconia, or oxide of zirconium; 20 per cent. of oxide of lanthanum; and 20 per cent. of oxide of yttrium. The oxide of yttrium may be dispensed with; the composition being then: 50 per cent. zirconia; 50 per cent. oxide of lanthanum. Instead of using the oxide of yttrium, ytterite earth, and instead of oxide of lanthanum, cerite earth, containing no didymium, and but little cerium, may be employed." A great deal of evidence and description was, as it seems to me, wasted upon the meaning of the last sentence, which appears to me to be perfectly clear. The oxides or

earths of the yttrium sub-group are very easy to separate; those of the cerium sub-group, very difficult indeed to disentangle from one another. If, therefore, you are getting your yttria from a natural mineral which contains besides yttria appreciable quantities of the other members of that sub-group, you need not go any farther, nor take any trouble to separate them from one another. They will do as they come. Of the cerium or ceria sub-group, lanthana is the oxide you want. Didymium you must eliminate; and much cerium will interfere with the desired results. Therefore, if you are approaching your lanthana through cerite earth—that is, through compound oxides of the cerium sub-group—you must get rid of the didymium, if the cerite earth contains it; and you must get rid of all but a small quantity of the cerium. If your cerite earth happens to contain no didymium and only a small quantity of cerium, it will do as it is, without further separation. It seems to me now possible to understand exactly what the patentee claims. It is not the prescription apart from the rest of the process. It is not the construction of a skeleton—or, as it has been aptly termed, a *simulacrum* of the vegetable fabric—in any oxides, or in any oxides that will give good or durable incandescence (a claim which would certainly vitiate the patent), but it is the combination of the various essential elements in the process described—the manufacture of the hood out of the substances which are mentioned by the patentee, no doubt because he had ascertained that they would answer, by the means of impregnation with the blends of salts within the descriptions and proportions indicated by the specification. This would include, of course, all such variations of proportions or of strength of solution as are fairly within the specification, as it would be understood by a competent workman, and brought to its final condition for every-day use by being put into the burner, and so having the carbon filaments and threads burned out, and the anhydrous oxides left in the precise shape which the fabric had, till burned out, assumed. If the process which the defendants held out that they were going to use is substantially identical with this process, they are liable in this action. If it is not so, they are entitled to my judgment.

But before discussing the question of infringement, I must deal with the objections which are raised to the patent itself. They comprehend nearly every objection that can be raised. The invention, it is said, was not the proper subject of a patent, having regard to the state of common knowledge at the time. It was not new; it was not useful. The specification is too vague, because the proportions of the oxides are misleading, and would not produce a good result, and because no sufficient directions are given as to the strength of the solutions or the means of burning out the fibrous material. The specification does not sufficiently distinguish between what is old and what is new in the invention. I will deal with these objections *seriatim*.

1.—The invention was not the proper subject of a patent, with reference to what was known; and it was not novel. In my opinion, these objections are singularly ill-founded. The invention, with improvements which have naturally followed in its train, has undoubtedly created a great new industry, not only in the caps or hoods which are the subjects of it, but in the extraction of the oxides and salts of the rare metals. The globe has been ransacked for new sources of supply. How great in this direction has been the effect of Welsbach's discovery, will be found in an interesting passage in Professor Dewar's evidence, to which no exception has been taken. The invention has accomplished what has long been a desideratum—what has been attempted before, but always with an utter want of success; and it has for the first time brought within the range of practical manufacture the production of a brilliant light by incandescence within an ordinary gas-flame. The evidence on this point seems to me absolutely conclusive; but it is right that I should consider in detail the various alleged anticipations which have been relied upon. The first is a specification No. 8141, of 1839, by one Alexander Cruickshank, who proposed to coat a cage of platinum with lime—the coating to be obtained by dipping the platinum cage into chalk and water, or covering it with quicklime, and then putting the cage over the gas-flame. The process, however, is perfectly useless. The oxide of calcium simply drops off the platinum; and it is impossible to get a coherent structure of the oxide. The different rates of expansion of platinum and oxide of calcium alone seem a sufficient explanation of the futility of Cruickshank's suggestion, apart from the absolute difference between his mechanical coating of the metal by the lime and the chemical method of Welsbach's patent, by which the nitrates are made to submit to decomposition and deposit their oxides. The next alleged anticipations are to be found in two patents taken out in 1880 and 1883 respectively on behalf of a French gentleman named Clamond. The first is for an attempt to apply the incandescent qualities of lime or similar substances, such as magnesia or zirconia (of which we have a familiar example in the ordinary oxy-hydrogen or lime light), to burners for domestic use, and has absolutely nothing in common with Welsbach's process. The second was on similar lines with the first, and proposed to direct a jet of mixed gas and air against a set of small parallel cylinders or sticks of magnesia, which were to be rendered incandescent by the flame of the jet. It was again a kind of modified oxy-hydrogen lime-light, and in no way comparable with Welsbach's invention. The next suggested anticipation is in a provisional specification of 1882, filed by William Robert Lake on behalf of one Stokes-Williams, of New Jersey, U.S.A. It contains no less than 43 different heads, and embraces a vast variety of suggestions—many of the very crudest nature. By his 18th paragraph, he proposes to build up or form the light-emitting portions of what he calls his thermo-candle by the deposition of metal or metal alloys upon an earthy material such as zirconia, gypsum, lime, &c.; obviously proposing metal as the source of incandescence. Under his 21st head, he proposes to construct the said light-emitting portions by the deposition (apparently by a process of electrolysis) of metal or metal alloys upon filaments, strings, threads, or pieces of cotton, &c.; and, under the 22nd head, to form the same light-emitting portions by the deposition of highly refractory metals or alloys upon a base or form of other materials—some sort of metal framework, which was, I presume, to incandesce, and so give out light. The parts of the specification from heads 31 to 39 were relied upon. But they again all, or almost all, relate to the deposit, in some fashion or other—generally by a process of something like electrotyping—of some metal which is to give out light. He suggests in one place that a destructible material can be used as the base upon which to effect this metallic deposit; and then that the base may be burned away, leaving a very thin metal frame—thinner than can be obtained in any other way—and that such thin framework may be alloyed with, or covered with, or coated with other and indestructible materials, such as magnesium, zirconia, &c. Still the metal is to coat the framework and be the incandescing thing; and he suggests that, by decomposition and recomposition of "salts or oxides of metals," a metallic coating may be obtained for a piece of fibre, gauze, asbestos, muslin, or what not, which has previously been "dipped in salts or oxides of magnesium or other material." Two passages numbered 38 and 39 have been pressed upon me over and over again, as containing a kind of germ of Welsbach's invention. It requires, in my opinion, all the extreme benevolence of construction and inference always bestowed by those who desire to possess themselves without payment of the fruits of another's industry and brains, to extract from them a hint in the direction of what Welsbach has done. Welsbach has shown how to do it; and it is astonishing to find how easily it is done, and how readily it is to be got out of Stokes-Williams's generalities by those to whom Welsbach has shown the way. I have no doubt the companions of Columbus took the same view of the problem how to make the egg stand upright, after he had solved it for them. As to No. 38, Dr. Hehner, the principal and extremely able scientific witness called on behalf of the defendants, confessed at last that he could make neither head nor tail of it; and for all practical purposes No. 39 is very little better. Stokes-Williams gives me the notion of being a man with a wide range of extremely superficial knowledge; and when whatever there may be of ingenious suggestion is buried beneath a hopeless mass of unintelligible generalities and ambiguities, which deprive it of any practical use, it cannot be regarded as deserving of serious notice as an anticipation. There is scarcely a discovery in the arts or in physics for which some vague ante-type may not be found in earlier writings. The glacier theory which Professor Forbes reduced to a scientific certainty, was in such a sense anticipated by Bishop Rendu; and Perkins's steam-gun, which used to be exhibited when I was a boy, was anticipated by every lad who stuck a bit of cork into the mouth of a tea-kettle, and watched the steam blow it out. The next anticipation relied upon is contained in a patent of 1883 taken out by William Heather Spence on behalf of a Swede named Fahnehjelm. This, again, consists of a number of small sticks or pins made of the powdered oxides of magnesium, calcium, zirconium, silicon, or similar materials, which are to be exposed to the flame of water gas. They are to be made into a paste, with gum or starch, &c., and then moulded into the right shape. It is another application of the principle of the oxy-hydrogen lime-light, and presents not the least resemblance to Welsbach's invention. The last of the alleged anticipations are to be found in three papers published respectively in a German technological periodical, and in two issues of a like journal in France about the years 1848–9, relating to a process by which one Frankenstein professed to have saturated tissues of one sort or another with a mechanical mixture of powdered lime or magnesia, or lime and magnesia, or chalk and calcined magnesia, with water alone, or with water and gum arabic, or some similar material. The tissue was then made into a suitable form, introduced into the burner, and set fire to. Frankenstein asserted that, with great care, the remaining earthy substances would hold together during one period, and give a bright light. There is absolutely no analogy between this mechanical application of the substances intended to incandesce and the chemical mode of deposition of the oxides upon and within the interstices of the fabric to be destroyed, which is effected by the Welsbach process. It is further proved by the plaintiffs' witnesses, and admitted by those for the defendants, that it is absolutely impossible to obtain even the slightest coherence alleged to have been secured by Frankenstein, without the introduction of the salts of sodium or some other body into the mixture. There appears to me, therefore, to be no ground whatever for the attack upon the patent on the score of want of novelty. The field upon which Welsbach entered was untrodden, and marked only by the absolute failure of every attempt to penetrate it.

2.—It is next set up that the invention was not useful—a singularly hopeless contention. The invention has, no doubt, undergone many improvements since it was first introduced; and it would be unfair to estimate the value of the results achieved in 1885 or early in 1886 by the brilliant incandescent lighting of the present day. But the evidence is conclusive that with the original invention of 1885, and nothing else, a candle power per cubic foot per hour of gas consumed was obtained which greatly surpassed the best result obtainable at that date. Mr. Sugg was the only witness called to give evidence in a contrary direction. Welsbach saw him in May, 1886, with reference to taking up the patent. Mr. Sugg was largely interested in what were known as regenerative gas-burners; and he was not likely to look with a favourable eye upon an invention which would interfere with his own business. He was very hazy in his recollection of candle power; but he thought it about equal to that produced by his own processes. The evidence, on the other hand, of the plaintiff's witnesses is definite and precise; and it came from persons upon whom I feel that I can place reliance. Mr. Sugg also said that the invention in 1886 was not likely to be a commercial success—a view very likely to tinge his recollections unfavourably, but having nothing to do with the question of utility in reference to the validity of a patent. Under the head of non-utility may be considered a very serious attack upon the patent, very stubbornly maintained, in respect of the direction in the specification to ammoniate the mantle before burning it—a direction which it was said would, under some conditions not excluded by the specification, be fatal to the mantle, which would, in such cases, fall to pieces. The evidence upon this head has been given piecemeal. Strictly speaking, it ought to have been closed before the learned Counsel began their concluding addresses in the De Mare case. This case, however, was followed by another against the Sunlight Company, in which the same question arose, and as to which I could not limit the inquiry to the evidence in the first case. The result has been that practically I am applying the evidence on the subject of

ammoniation given in both cases to the action with which I am now dealing; and as each fresh allegation of a new cause or element of failure had, as a matter of common fairness, to be tested by the plaintiffs, the cross-examination of whose witnesses had not indicated what was going to be said, there has been an amount of evidence and discussion backwards and forwards, which, however inevitable, is undesirable, and has been embarrassing enough to me—though it has ended, notwithstanding great complication, in a very simple result. I do not propose to go into any considerable detail, though I think it necessary to give an accurate outline of what took place. The plaintiffs gave evidence in the first instance, by several witnesses, that they had made ammoniated mantles by the Welsbach specification of 1885, and nothing else. They were all good chemists; but a skilled workman for the purpose of such a manufacture as that of the present patent, must be a skilled chemist. They were of precisely the same class as the witnesses called by the defendants to show that they had failed; and no exception has been taken to them on the ground that they were not of the right class to test the specification. The ammoniated mantles made by the plaintiffs' witnesses—running into the hundreds—were all coherent and satisfactory. The process was performed in Court. The defendants' witnesses, on the other hand, said they had made ammoniated mantles in great numbers by the specification, which all fell to pieces; and all those which they made in Court did fall to pieces. The plaintiffs suggested impurity in the materials. The defendants answered that they had procured the materials from known chemical manufacturers—that they were commercial articles, and must be taken with the ordinary risk of impurity attaching to a commercial article. There is a fallacy here. In 1885, neither the salts of zirconia nor those of any of the rare metals in question were in any true sense commercial articles. A chemical manufacturer would produce them if ordered; and they figured in catalogues of chemical manufacturers, at prices per gramme which, in the case of nitrate of zirconia, works out to £3 an ounce. The prices of some of the other substances were very much greater. There was, in fact, at that time, no commercial use for them at all. Some of the salts of cerium were used in medicine for certain disorders of women; and zirconia was occasionally used for the oxy-hydrogen light. There was no other use for any of them, except for laboratory experiments; and I think it clear that, under these circumstances, the patentee is not hurt by the fact that now that, in consequence of his invention, a large industry in these things has sprung up, there may be sources of danger in the now commercial article which he could not anticipate. I think he is entitled to be judged by the results when the components of his prescription are used in a substantially pure state. I am sure this was the view originally taken by the defendants' Counsel and witnesses, for every witness called by the plaintiffs described the process he had used, and how he had purified the salt; and it was not even hinted at in cross-examination that anything unreasonable in this respect had been done. Mr. Swinburne, upon whom the brunt of a great part of the battle fell, described in his evidence the steps he had taken to get the salts required pure; and no suggestion was made till the defendants were answered upon all other points touching the ammoniation, that anything had been done to which the patentee was not fairly entitled. I am satisfied quite as much by what was not said as by what was said, that any fair-minded man who had wished to make a Welsbach mantle by the specification, would have begun by seeing that his chemicals were substantially pure. The plaintiffs, of course, asked to be allowed to test the solutions which had led to failure in the hands of the defendants' scientific witnesses—a most reasonable demand, stoutly resisted, as were other reasonable requests of the same kind, and acceded to only after pressure from myself. It turned out that they contained 10 per cent. of nitrate of potash. "That," said defendants' witnesses, "is of no consequence." "How do you know that?" was the natural question. The answer was a remarkable one. Instead of saying: "We have cleared the solution of its 10 per cent. of nitrate of potash," which can be done with perfect ease, they said: "We have taken a perfectly pure solution, and added to it 10 per cent. of nitrate of potash, and it makes no difference." The plaintiffs answered—and it seemed to me a good answer—"We have taken the solution with which you have failed, and simply by purifying it have got perfectly good mantles." Mr. Ballantyne was put into the box, and described how he had purified the solution—omitting details, it is sufficient to say—by the use of hyposulphite of soda. No exception was taken at the time to the method which he had adopted for purifying the solution. This was on Friday, the 20th of March. By Monday morning, the 23rd, the defendants had discovered that this was not the right way of purifying the zirconium salt, according to the knowledge of 1885, but that it ought to be purified by ammonia; and that, if the ammoniacal method of purifying the nitrate of zirconia were adopted, the mantles would fail. A very intricate inquiry was embarked upon, having, to my mind, no practical bearing upon the subject, as to whether this remarkable difference in the behaviour, according to the preparation by one process or the other, of the two specimens of nitrate of zirconium, was due to a hitherto undiscovered existence of two allotropic or isomeric forms of zirconium, or to some other abstruse chemical or physical cause. The plaintiffs said again: "Let us have a sample of the chemicals you have been at work with, and let us see whether there is any real mystery about it." With some difficulty again, they got a sample to work upon; and, using the ammonia method of purification (which is the only one that is said to point the way to failure), Mr. Ballantyne produced without any difficulty good mantles. He was put into the box again on Friday, the 27th of March, and detailed exactly what he had done. The only difference between his treatment and that of the defendants was that he had washed the precipitate produced by the ammonia, which the defendants had not done. The defendants themselves had found out that if this precipitate was washed, or "even stood in the presence of water"—whatever that may mean (something, I suppose, less than actual washing)—the process succeeded. So that the question was now reduced to whether Mr. Ballantyne had taken more precautions in the way of washing than would naturally be taken by a person possessed of the necessary chemical knowledge to make him "a fairly skilled workman" with respect to the preparation of nitrate of zirconia. Mr. Ballantyne—whom I entirely believe—not only said that he had never taken more than the ordinary laboratory precautions for the preparation of nitrate of zirconia, but gave excellent technical reasons which I or anyone else, though not a chemist, can perfectly understand, why such precautions are always adopted with respect to zirconia and some kindred substances. It turned out that he had used less than the amount of precaution which he would have used under ordinary circumstances, because—the evidence on behalf of the defendants, which really did look as if there might be a serious cause against the patent, having been given on Monday morning, the 23rd of March—he had been anxious, if possible, to conclude his experiments before the rising of the Court, and had therefore washed and filtered less than he ordinarily would have done. Mr. Bousfield recurred, in the cross-examination of Mr. Ballantyne, to the subject of allotropy, and of the physical causes which make the difference between washing and not washing of importance. To me they seem utterly irrelevant. It may be that "standing in presence of water," and still more washing, produces a change of condition, and gives an allotropic variety of nitrate of zirconia which is useful where the other variety is useless, or it may be, as Mr. Ballantyne inclines to think, simply that zirconia and its salts belong to a class of substances long known to be specially liable to impurity, and therefore a reasonable chemist would wash them carefully before he used them. Whatever the reason, I am satisfied with Mr. Ballantyne's evidence that careful washing is the ordinary treatment, and that he has found no difficulty with a washing even less thorough than would be ordinarily applied, and that the defendants' difficulties are due to the fact that they did not reasonably cleanse the precipitate. I wish to add that Mr. Ballantyne has given me reason to rely upon him. He is one of the most truthful and fairest-minded men I have seen in the box. On Monday, March 30, when the evidence in the second case was still going on, Mr. Bousfield returned to the charge. On the previous Thursday, Dr. Hehner had procured a fresh sample of nitrate of zirconia from a German manufacturer named Mirck, with whose nitrate he had had the least difficulty. This, he said, he had tested. It was substantially pure; and yet he could not make mantles with it. I do not wish to repeat what I have said as to the use of an article, now become a commercial product made on a large scale, as a test for the sufficiency of a specification which could be exposed to no such risks as may be incident to the production of an article of commerce—a totally different thing from its preparation in minute quantities for laboratory experiments. But there is a circumstance connected with this matter which justifies, I think, my refusal to act upon this evidence, or to submit it to further experiment by the plaintiffs. Some communication had passed, it appears, on the Thursday between leading Counsel, by which Mr. Moulton knew from Mr. Bousfield that some evidence of this kind would be given. Mr. Moulton therefore, on the Friday, took occasion to say that if there were any further attack to be made with respect to ammoniation, he trusted they might have a sample of anything with which the defendants could not make a mantle, and he would undertake to make one, and to explain what the difficulty was. Obviously it ought to have been given. But Mr. Bousfield would give no sample then; and none was given either then or afterwards. It turned out on the Monday (the 30th) that the incriminated nitrate of zirconia was in Court, when Mr. Bousfield raised difficulties about then giving a sample in quantities abundantly sufficient for a host of experiments; and that Dr. Hehner was only prevented from handing it to the other side by Mr. Bousfield himself. There has been, indeed, a marked difference throughout the case between the perfect readiness of the plaintiffs to hand over to the defendants samples of anything in their possession which had been the subject of evidence, and the reluctance exhibited on the part of the defendants to do the like by their opponents, where the commonest fair play seemed to me to require the delivery of a sample. I cannot persuade myself to entertain a serious doubt that, if the opportunity had been afforded to the plaintiffs' chemists, they would have disposed of this difficulty as satisfactorily as they have dealt with every other element of this attack upon the patent. This ground of objection to the validity of the patent, therefore, in my opinion, completely fails. It occupied, in the aggregate, the equivalent of at least two or three days; and the matters involved have been so completely thrashed out that I should hope this inquiry may at any rate set that matter at rest.

3.—The next ground of attack is that the proportions of the oxides given are wrong, and no directions are given as to the strength of the solutions; and that a competent workman would need other and further directions. The subject-matter of the specification is such that no one but a person possessing a very considerable amount of chemical knowledge could, at the date of the specification, be considered a competent workman. The proportions actually given are right, and work satisfactorily. The hoods can be produced and made coherent with solutions very widely differing in strength; and I am satisfied with and accept the evidence of the plaintiffs' witnesses, who say that the want of a direction as to the strength of the solutions would have presented no real difficulty to a man competent to do this class of work. Excellent hoods were made by persons at the time unacquainted with anything but the Welsbach specification, and who received no other information than that contained in the specification—made at once, without further experiments, and with no failures; and it was not suggested that Mr. Ballantyne and Mr. Cooper (good chemists, no doubt) were not fair types of the "skilled workman" as applied to the subject-matter in hand. Many questions were put to the defendants' witnesses as to whether one set of proportions and one strength of solution would not produce a better result than another. Except with regard to the ammoniation, with which I have already dealt, no one has said that he has found any difficulty in making an effective mantle, satisfying the conditions to be attained, for want of more specific directions. Sir Henry Roscoe, of whose evidence I desire to speak with the utmost respect, said that the proportions and strength of solutions were matters of importance, as no doubt they were, but he did not say that he or anyone else had failed by reason of vagueness in these respects in the specification.

4.—An objection is raised on the pleadings that the specification does not sufficiently distinguish between what is old and what is new in the invention. As, however, not a word has been said about it in the

course of the case, I need say no more than that, in my opinion, in such a specification as the one I am dealing with, no such distinction is necessary.

I pass now to the only remaining question—the very important one of infringement as threatened by the defendants. The defendants have very plainly stated what it is that they say they intend to do. In answer to the fourth interrogatory, it is said that the defendants intend to construct and sell in this country plumes for incandescent lamps in the manner referred to in paragraphs 2 and 12 of the affidavit of De Mare and Franchet, sworn on May 28, 1895. In paragraph 2 of that affidavit, De Mare describes his system by reference to two patents taken out by him in 1894 and 1895, and an application of April 11, 1895. The application of April, 1895, is the only material document. It describes the plumes somewhat imperfectly; but as specimens were given by the defendants to the plaintiffs in the course of this litigation, and as one was made an exhibit at the trial, there is no doubt as to what was intended. A plume consists of a number of threads tied on to a platinum wire, and arranged so as to form a sort of fringe, all the threads of which are brought very closely together, while they are strung on to the wire, but allowed to separate as they leave it; so that the apparatus looks like a small housemaid's hand-brush, the cross section of which would take the shape of a fan. This plume is then to be dipped into a solution consisting preferably of one part of sulphate of magnesium, two parts of sulphate of erbium, and two parts of sulphate of zirconium (all chemically pure) in 25 parts of water—that is, so far as the salts are concerned, sulphate of magnesium 20 per cent., sulphate of erbium 40 per cent., sulphate of zirconium 40 per cent. The plume may be dipped into collodion or varnish for the sake of strength, and is then to be suspended in the flame of a gas-burner to produce incandescence. In paragraph 12, Franchet, the other deponent, sets forth the solution employed by him in manufacturing a certain set of six plumes, five of which are mentioned in the plaintiffs' particulars of objection as having been handed to the plaintiffs on April 25, 1895, by one Edward Robotham, and as types of the contemplated infringements. Franchet says he used for these plumes nitrate of zirconium, about 50 per cent.; nitrate of erbium, about 30 per cent.; sulphate of magnesium, about 10 per cent.; and sulphate of bismuth, about 5 per cent. I have no means of translating the percentages of sulphates into nitrates, or *vice versâ*; but as they are referred to in the answer to the fourth interrogatory as if they were the same, and it has not been suggested that there is any material difference between the two formulæ, I must assume that they are substantially alike. The small percentage of sulphate of bismuth added by Franchet appears to have no sensible effect, except slightly to increase the strength of the plumes. It volatilizes on the application of heat, and is not material. The evidence of infringement, or intended infringement, however, does not stop here. In October last, the plaintiffs' Solicitors applied to the defendants' Solicitors for "some of the De Mare fringes similar to the five supplied by Robotham to the plaintiffs;" and on the 22nd of October, 1895, the defendants' Solicitors wrote to the plaintiffs' Solicitors, quoting the above words of the letter of the plaintiffs' Solicitors, and enclosing six more fringes prepared by M. Franchet. These six therefore were clearly delivered as specimens of what the defendants proposed to make. One of them has been analyzed by Mr. Ballantyne for the plaintiffs. He found it to consist of oxides of zirconium, 84 per cent.; oxides of the yttrium sub-group, 9 per cent.; and oxide of magnesium, 7 per cent. The defendants' Solicitors, at the same time that they sent six fringes to the plaintiffs' Solicitors, sent four out of a batch of twelve from which the six sent to the plaintiffs' Solicitors had been taken, and which they had procured from De Mare in Paris, to their own Chemist, Dr. Hehner, for analysis. He found them to consist of oxide of zirconium, 55 per cent.; oxides of the yttrium sub-group (including erbium), 38 per cent.; and oxide of magnesium, 7 per cent. The composition of the fringes delivered during the course of the trial is not in itself any cause of action; but it is evidence of what the defendants were likely to do. With these varying compounds, it is not easy to say exactly what the defendants meant to do; and I think it pretty clear that they were not very certain themselves. They evidently depended upon De Mare for their samples of plumes, for it appeared that it was to him that they resorted to get them. Mr. Bousfield said more than once that he was going to call De Mare. Possibly these analyses may explain why he did not do so. Enough, however, appears to satisfy me that, unless the omission of the ammoniation, the omission of lanthana, and the variation in the form of the illuminant appliance, prevent me from saying that the substance of Welsbach's patent has been taken, the defendants were about to infringe, and ought to be restrained. Welsbach's limits of proportion are very large. Only one witness for the defendants attempted to put a definite figure to the "certain limits" within which the specification says the proportions may be varied. He said that a variation of from 25 to 30 per cent. upon the figures given would not be an unfair way of looking at it. No one has translated for me De Mare's sulphates, or Franchet's nitrates and sulphates, into the corresponding proportions of oxides; but so little has been said about there being any substantial difference, that I should be disposed to infer that Dr. Hehner's analysis of four fringes probably gives something approaching to the true proportion of oxides. If so, the substantial difference between the two sets of prescriptions—those of the plaintiffs and those of the defendants—consists in the omission of the oxide of lanthanum. Of course, when the oxide of lanthanum was left out, the proportions of the remaining substances must be altered in some way or other. No reason was given for the omission of lanthanum. The omission undoubtedly involves some loss of the light-giving power of the plume; and generally no advantage has been suggested as obtained by any variation there may be between Welsbach's and De Mare's proportions of the oxides or salts. The non-ammoniation is very easily disposed of. Professor Crookes—a very great authority—called for the defendants, said that in his opinion ammoniation was not necessary to arrive at the result proposed by the patentee; and it appears that the only effect, apart from the danger attending ammoniation which I have already discussed, of dropping it, is that, when you expose to the gas-flame the fabric impregnated with nitrates, you drive off, in the shape of nitrous acid, the nitrogen and the greater part of the oxygen, leaving one equivalent of oxygen, which combines with the metallic bases and produces an anhydrous oxide or anhydrous oxides; so that you get at the same result by one step as you get at by two steps if you ammoniated the fabric. This is strictly the use of a chemical equivalent perfectly well known at the date of the patent, and can have no bearing upon the question of infringement. The plume is, no doubt, a form of appliance suited to a batswing burner, to which the Welsbach cap or hood would be inapplicable. Welsbach, however, points out that the form and construction of the fabric may be varied to suit different burners. It is urged that the plume is not a fabric at all. I do not know why not. It consists not of a single thread, but of a number of threads mechanically held together by a wire, and, I think, by another thread. Why is not a plume a "fabric"? The essential part of it, for the present purpose, is the agglomeration of threads. The defendants say that nothing but a textile fabric is a fabric. I can see no reason for putting such a limitation upon the word.

Before I go further, I wish to discuss the principles which appear to me to be applicable to the question of infringement. In dealing with the question of construction, I have carefully avoided any reference to the relative importance of different parts of the invention. In dealing with the question of infringement, it is impossible not to consider them. Infringement is a question of fact for the jury, if there be one; and the question is not whether the substantial part of the process said to be an infringement has been taken from the specification, but the very different one of whether what is done or proposed to be done takes from the patentee the substance of his invention. A process might be wholly gathered from a specification, and nowhere else, and yet be no infringement if it did not take substantially the thing invented. What the thing invented is must be gathered from the specification alone; and the patentee cannot escape from the thing he has claimed as the standard, and the only standard, with which to compare the alleged infringement, so as to see if it constitutes substantially the appropriation of the thing claimed. When, however, you come to make that comparison, how can you escape from considering the relative magnitude and value of the things taken and of those left or varied? It is seldom that the infringer does the thing, the whole thing, and nothing but the thing claimed by the specification. He always varies, adds, omits; and the only protection the patentee has in such a case lies, as has been often pointed out by every tribunal, from the House of Lords downwards, in the good sense of the tribunal which has to decide whether the substance of the invention has been pirated. It is contended by the defendants that what is important and what is of subsidiary consequence can only be gathered from the specification itself. I am satisfied that this neither is nor can be the law. Certainly *Dudgeon v. Thomson*, which was cited as an authority to that effect, says nothing of the kind. "Additions or subtractions," says Lord Cairns, "may exist, and yet the thing protected by the specification may be taken notwithstanding." There is no means of ascertaining whether, notwithstanding additions or subtractions, the invention has been taken, except by seeing what they are worth as compared with the things which have been taken bodily from the invention. In the case of a patent for a combination, or for a series of operations, the specification very often contains no clue to the inventor's own view of the relative importance of the different elements in the combination. If he says nothing on the subject, you must conclude that, as far as the specification goes, they are all presented as of equal importance, and all as essential parts of the combined whole; and yet there may be infringement, notwithstanding "slight variations." Lord Justice Cotton, in *Proctor v. Bennis*, says: "Omissions and additions may be very material in considering whether in fact the machine of the defendant is an infringement of the combination which the plaintiff claims." Omissions and additions may even be improvements; but that fact does not enable you, says Lord Justice Bowen, "to take the substance of the plaintiff's patent." "If the instrument patented," says Lord Cairns, "consisted of twelve different steps, producing in the result the improved clipper, an infringer who had taken eight, nine, or ten of those steps might be held by the tribunal judging of the patent to have taken the substance—the pith and marrow—of the invention, although there were one, two, three, four, or five steps which he might not actually have taken." (*Clark v. Adie.*) In such a case, as far as the specification went, the patentee would, under ordinary circumstances, treat the whole of the twelve steps as essential points of his combination, and, so far as the specification went, there would be nothing to indicate that any one of them was not indispensable, or was of less importance than the others. In *Proctor v. Bennis*, there was nothing to indicate that the patentee thought the parts of his combination omitted or varied by the defendant of anything but cardinal importance. How was the question suggested by Lord Justice Cotton, whether the variations were "slight," to be ascertained, except by evidence as to the relative importance of the variations in question as compared with the patented combination as a whole? "There is or may be," say Lord Justice James and Lord Justice Mellish, "an essence or substance of the invention underlying the mere accident of form; and that invention, like every other invention, may be pirated by a theft in a disguised or mutilated form, and it will be in every case a question of fact whether the alleged piracy is the same in substance and effect, or is a substantially new or different combination." (*Clark v. Adie.*) Drop the word "combination," which is perfectly immaterial as regards the principle, and every word is applicable to the present case. Mr. Bousfield says I am not entitled to take this as an accurate statement of the law, as the case went to the House of Lords; and no such doctrine is, as he contends, enunciated by the Law Lords. This, however, is a mistake. Lord Cairns expressly says: "I am quite satisfied with the judgment of the learned Lords Justices; and I should have been content to rest the decision of this case upon that judgment but for its importance."

There can be no doubt of the importance attached by Welsbach to the use of the oxide of lanthanum, which he clearly regards as a thing not to be omitted from what he claims; and he therefore enters upon the contest as to infringement heavily handicapped as it were by his own view of the great importance of the use of lanthanum in his prescription. But, for the reasons I have already given, I think the fact has no further weight, and leaves me free to exercise my own judgment

in weighing this fact with others when dealing with the question of infringement. If the patent consisted of the mere prescription, the omission of lanthanum and the variations of the proportions would of course prevent the defendants from being treated as infringers. But this is not a patent of that description. The claim is far wider; and the patentee is accordingly entitled to a larger measure of protection. "It goes to the very root of the case," says Lord Justice Bowen, speaking of infringement, "to remember that this is, as it was described by one of the Counsel, a pioneer invention; and it is by the light of that, as it seems to me, that we ought to consider the question whether there have been variations or omissions and additions which prevent the machine complained of from being an infringement of the plaintiff's." I think, in substance, this is the same thing as saying that if the specification shows that a result which is in fact new is attained by the combination described, and the claim extends to the process by which that result is arrived at, the substance which is to be regarded on a question of infringement is of a very different character from what it is when the result is an old one and a known one, in which case the claim, if a good one, must be limited to the very combination patented. Now, what was the character of Welsbach's invention, so far as result is concerned? It was undoubtedly a perfectly new result, and in every respect deserving the name of a "pioneer" invention. The phrase is not mine, but Lord Justice Bowen's—I use it only as a compendious way of repeating what I have already said; and the substance of what Lord Justice Bowen said is expressed in other words by both Lord Justice Cotton and Lord Justice Fry. Welsbach certainly discovered for the first time a method by which a skeleton, frail but durable, of the resistant earthy oxides mentioned by him, could be produced which would give practically a means of obtaining light by incandescence, which would surpass the economy of the best modes known of getting illumination from gas. His specification claims the whole process by which he arrived at that result. Out of it the defendants take the impregnation of the fabric by blends of salts of zirconia and of the rare earths, and the reduction of these to anhydrous oxides forming the *simulacrum* of the fabric. I am satisfied by the evidence that it is this mode of getting blends of the specified oxides into the shape of the fabric out of which the hood has been made, that has rendered the process of any use; and that a mere variation of the prescription, extending even to the omission of lanthana, is of very trifling consequence in comparison. Mr. Bousfield's contention comes shortly to this—that, looking to the variations in the prescription, and especially to the omission of lanthana, if I were trying this case with a jury it would be a miscarriage if I left the question of infringement to them, and that I should be bound to give judgment for the defendants. I am of opinion that the case would have to be left to the jury. If it be left to me as a jury, I have no hesitation at all in finding that the defendants propose to take the substance of the Welsbach process. I prefer the expression "substance" to "pith and marrow," even though that phrase was used by Lord Cairns. I have had some difficulty in preventing myself from misapplying it; and I think it would be very likely to mislead a jury. Pith is a great deal less than the substance of the vegetable structure of which it is part; and marrow is a great deal less than the substance of the animal structure of which it is part. Metaphors are very apt to mislead, as they are seldom close enough to the things to which they are applied. It has been urged upon me that the patent cannot have been infringed because chemical patents cover only such chemical equivalents as were known at the date of the patent to be equivalents; and inasmuch as it was not known that a like result might be obtained by the omission as by the use of lanthana in the blend, there can be no infringement by a process which drops lanthana; and *Heath v. Unwin* was pressed upon me over and over again, as well as a passage with regard to mechanical equivalents in *The Ticket-Punch Register Company v. Colley's Patents*. *Heath v. Unwin*, in my opinion, has no application at all. There the patent was not for a combination of a long series of steps, but for one simple and single chemical operation, which it was held was not initiated by a process of a very different kind which resulted in producing the same effect. The result obtained was not new. The carbonization or decarbonization, as the case may be, of iron is the essential condition of making steel; and Heath's patent covered only a new mode of effecting that result. It has no analogy with such a patent as the present, in which the use of the blend containing the oxide of lanthanum is a mere element of a large combination. To apply it would reduce the patent owned by the plaintiffs to one for a mere formula, which is really what most of Mr. Bousfield's arguments have come round to. So in the Ticket-Punch Company's case, the remarks of Lord Justice Smith as to the decision in *Proctor v. Bennis*, however applicable in the circumstances of that case, have really no bearing upon the present one, in which it is only in respect of one very subordinate matter in a long chain of operations that any question of chemical equivalents can arise.

The substance of Welsbach's invention, as described in his specification, according to the construction which I have put upon it, is, in my opinion, appropriated by what the defendants were proposing to do; and I therefore give judgment against all the defendants upon all the issues, with costs, and grant the injunction prayed for. I certify, pursuant to section 31 of the Patents and Trade Marks Act, 1883, that upon the trial of this action the validity of the letters patent, granted to Carl Auer von Welsbach (No. 15,286, dated the 12th of December, 1885) came into question; and I further certify, pursuant to section 29 of the same Act, that on the trial of this action the plaintiffs proved the particulars of breaches delivered by them.

Some questions as to costs being raised,

His Lordship said the matter might be mentioned on a subsequent day. He then proceeded to deliver judgment in the Sunlight case, as follows:—

In this case, the plaintiffs complain of infringement and threatened infringement in respect of the patent of 1885, to which the De Mare case relates; and also of one granted to Oliver Imray, being No. 3592 of 1886, and one granted to Ludwig Haitinger, being No. 586 of 1891. As, however, the grounds of action in respect of the latter two patents were abandoned during the hearing, I have nothing to add to the judgment just delivered in the De Mare case, so far as relates to the construction and validity of Welsbach's patent; and have to deal only with the question of infringement. The defendant Company was formed to work a patent granted to one Dellwik, being No. 2110 of 1890, for "Improvements in the process of treating incandescents for use with gas lamps or burners." Dellwik's patent does not impress me favourably. It is full of what, after Sir Henry Roscoe's evidence, I am fully justified in calling nonsense, about the conduction of heat and the selection of substances because of their conducting power; and I doubt if this rubbish was put in for any other purpose than to try and make it look unlike Welsbach's process. The fact, however, that the patentee was trying, by means not creditable, to escape a danger, will not make the process an infringement of Welsbach's patent if it is not so in fact. It is extremely difficult to say what Dellwik really describes. He says he takes "the ordinary incandescent," and treats it by such and such means. If under the "ordinary incandescent" he includes the incandescent fabric of Welsbach, produced under his patent, the defendants could not, of course, make such a fabric, and then subject it to his process, without infringing Welsbach's patent. But as that would be not to gild refined gold, but to coat it with brass, I do not suppose there is any danger of that being done; nor has it been suggested that it will be done. Dellwik confines his claim, so far as now material, to: (1) The treatment of incandescents—such as the oxides of calcium, magnesium, aluminium, zirconium, or similar metals of this group, or compounds of these oxides—by covering or saturating them with a coating of refractory oxide of a heavy metal or metals. (2) The treatment of incandescents (being similar oxides) by covering or saturating them with a coating of a more refractory oxide—such as the oxide of chromium, yttrium, lanthanum, didymium, and the like. (3) The like, coating the incandescents with oxides of heavy metals mixed with the oxides last mentioned, and some others. Here, again, there is at least a suspicion of a not very honest specification. To coat the fabric with oxide of didymium would it seems be fatal to its light-giving powers. It is, perhaps, better to see what the defendants are really doing, for it is not suggested that what they are actually doing is not an honest specimen of the work they intend to carry on. They take the idea of the skeleton hood produced by the Welsbach process, but make it of about 50 to 60 per cent. of alumina and about 30 per cent. of zirconia, and then cover this with a thin coating of oxide of chromium. They used to add a small percentage of a secret substance; but they have found that they do not need it, and are not now using it. I have seen what it is—the name having been deposited in a sealed envelope—and do not think it affects the case in any way. It seems to me that this is essentially different from what is claimed by the Welsbach specification. Mr. Moulton and Mr. Terrell have both put the matter very plainly and very fairly before me, and admit that they have no case unless the Welsbach skeleton—*i.e.*, the fabric of earthy oxide got by impregnation with a salt, and by the action of flame—of whatever resistant earthy oxides composed, is within the Welsbach patent. Mr. Terrell says the consequences of an adverse decision on this point are very grave. I am very sorry if they are so; but I cannot help it. It seems to me that this is just what Welsbach did not claim. He might, of course, have claimed the hood made of any materials. But that would have entirely altered his patent, and would have exposed it to a fresh set of dangers, which I cannot estimate, but which were no doubt present to his mind, and to that of his experienced Patent Agent, Mr. Imray. He might have claimed the hood, of whatever materials, applied for purposes of illumination; but that again would have altered his patent. In that form, it would have been, as Mr. Swinburne put it (with that perfect frankness, truth, and indifference to consequences which marked every answer that he gave, and made him the perfect ideal of what a scientific witness should be), a patent for the use, in the form of a hood, of whatever substance would answer, which would have made his patent not worth the paper upon which it was printed. But he did claim nothing of this kind; and seeing the manner in which he moulded his illuminants into shape—viz., by a chemical process of reduction from salts, and not by coating—it was absolutely necessary that he should select his substances from those which he had ascertained would give suitable illumination in the end; and the use of the rare earths is, beyond all doubt, for this reason, of the essence of his invention. He could not, by any adaptation of his process, make a strong groundwork of alumina, or alumina and zirconia, and then spray it or saturate it with the salt of an illuminant oxide to be reduced to the oxide on putting it into the flame, which is what the defendants have done. It was a necessary consequence of the nature of Welsbach's process that his skeleton should be absolutely homogeneous throughout. Take a fragment out of the structure from the back, the front, or the sides, from the rind or from the core, it must be the same in composition. Hence the whole fabric was a compromise between strength and illuminating power, except in a detail so unimportant that I have not thought it worth while to notice it. He could make no use of the great strength and tenacity of alumina, because it has practically no illuminating power. The Sunlight process uses alumina very largely indeed. It makes a hood which is a mixture, homogeneous throughout, of alumina and zirconia, and so gets greatly increased strength for the hood, with moderate illuminating power introduced by the zirconia. The idea of this part of the process is no doubt taken from the Welsbach patent. But the addition of a thin coating of oxide of chromium is what gives the illumination; and in this instance the substantial illuminant is not that portion of a homogeneous mantle which is exposed to the flame, but a foreign substance laid on in a thin film, and quite absent from the bulk of the structure. It is true you get much less light than by the Welsbach process. For many purposes, probably that is no disadvantage; and you get a yellowish, instead of an absolutely white, light, which also, in the opinion of many people, is no disadvantage. With the relative merits of the resulting mantles, however, I have nothing to do. Lord Halsbury said, in the ticket-punching case, that he gave his judgment with reluctance. In one sense, I may use the same phrase, for I do not think Mr. Moulton has exaggerated the value to the world of Welsbach's idea (or reduction to practice of the idea, whichever way it may be put) of getting a coherent skeleton of earthy oxides; and I feel that the defendants—and I doubt not that others have done the same—are taking a very valuable process bodily from Welsbach without any remuneration. But that is the necessary fate of a patentee who does not claim separately that which may be, in fact, the most ingenious

and meritorious part of his invention, and who confines himself to claiming the aggregate of a whole string of processes of which this is one. The construction of the skeleton is none the less ingenious and meritorious because it seems so simple when put into practice. Columbus's performance with the egg, to which I referred in the De Mare case, was very simple when it was once done. But, as far as this case is concerned, the fatal difficulty is that the formation of a Welsbach skeleton by other means and of other substances than those pointed out in the specification, or by means substantially identical and apart from the contemporaneous formation of the illuminants, is not claimed. If it were, or if there was infringement in the mere construction of a Welsbach skeleton out of the materials used by the defendants, I should, of course, agree with Mr. Moulton that the addition of a coating of oxide of chromium would not make it the less an infringement. But so to hold would, in my opinion, be practically to give to the specification a construction it cannot bear, and to turn it into a patent for the skeleton, no matter of what materials composed. No use is made by the defendants of any of the rare earths; and their choice of substances, and their method of applying the illuminants, appear to me to be as wide asunder as the poles from those contemplated by Welsbach. This case affords, to my mind, an interesting illustration of the criticism I ventured to make in the De Mare case upon the phrase which has been used as to taking the "pith and marrow" of an invention. It seems to me that in this case that is precisely what the defendants have done; and yet they have not taken its substance, or anything like it. I must therefore give judgment for the defendants upon the issue of infringement.

His LORDSHIP was proceeding to say that he found for the plaintiffs on the issue raised as to the validity of the patent, when

Mr. WALLACE, Q.C., pointed out that the issue of validity was not raised in this case, excepting in the event of the wider construction of the claim being adopted.

After a short discussion,

His LORDSHIP said he would look carefully at the pleadings before settling the form of the order, especially as to the costs. The matter might be mentioned on a subsequent day.

SOUTH-WESTERN POLICE COURT.

Friday, April 17.

(*Before Mr.* LANE, Q.C.)

The Defective Working of Prepayment Gas-Meters.

James Bolton, *George Thwaites*, and *Edward Pearce* were to-day summoned by The Gaslight and Coke Company for the non-payment of 7s. 10d., £1 2s. 5d., and 6s. 1d. respectively. The defendants had been supplied by the Company with meters having automatic prepayment attachments; and the amounts claimed represented in each case the difference between the pennies found in the box and the quantity of gas consumed as registered by the index.

Mr. LANE asked whether these cases were similar to that of *The Gaslight and Coke Company v. Newton*, decided by Mr. Baggallay at the West Ham Police Court on the 13th inst. (*ante*, p. 814), as he had carefully read the report of the judgment in that case, and, in his opinion, the learned Magistrate was decidedly correct.

Mr. R. H. HUMPHREYS, who appeared for the Company, stated that the case referred to by his Worship was on all-fours with those now before him, and that all the contracts were the same.

Mr. LANE said Mr. Baggallay had held that, by the contract entered into by the consumers, their liability was not limited to the pennies dropped into the slot, but that they were bound to pay for the gas they burned. The provisions for prepayment, and so forth, were, no doubt, adopted for the protection of the Company, and in the belief that the machines would operate rightly; but, if they did not, the Company were not to lose their gas. It appeared that in the cases of the present defendants the automatic machines did not act properly.

Defendants, having looked at copies of the contract, agreed that they were similar to those they had signed.

Mr. LANE said, this being so, he was prepared at once to give judgment for the amounts claimed, but without costs, as the defendants had acted in perfect confidence, and, not at all unnaturally, feeling that they were safe so long as they put in their pennies, and without apprehension of any further charge.

Mr. HUMPHREYS explained that he had applied to the defendants a dozen times, and given them every opportunity to pay, before they were summoned.

Bolton stated that he should never have got into debt had not the machine gone wrong.

Mr. LANE felt assured that this was the case.

Thwaites complained of some neglect concerning his meter, as the inspector found it was defective and let it run on, notwithstanding that he (Thwaites) wrote to the office.

Mr. LANE observed that, although there was good reason to complain of the way in which the machines had acted, the Gas Company did not warrant their perfect working. He added that of course the Company were entitled to costs; but that, seeing the defendants were poor men, and would not have incurred the debts if the machines had not gone wrong, they did not, as a matter of grace, ask for costs. No doubt the Company were as much disappointed with the machines as anyone else.

Bolton paid the 7s. 10d. for which he was summoned; and it was arranged that Thwaites should pay the £1 2s. 5d. in instalments of 10s. per month, and that Pearce should pay the 6s. 1d. within 28 days.

Dispute as to an Account for Lamps and Chimneys.

In the Queen's Bench Division of the High Court of Justice last Tuesday, Mr. Justice Day, sitting without a jury, had before him an action brought by the Metropolitan Light Company against Mr. J. Dunning, an ironmonger and dealer in lamps at Bournemouth, in respect of goods sold to him by the Company. The orders for the goods, consisting of lamps, chimneys, &c., were given by the defendant in June, 1895, to Mr. Norden, the plaintiffs' traveller. But, on the invoice being sent in, the defendant objected that the terms were not those on which he had placed the order; and of some of the goods he refused to take delivery. Voluminous correspondence ensued; and one account of £6 17s. 9d. had been paid—the balance sued for being about £50. Some of the goods which defendant objected to take were lamp-chimneys specially manufactured for him, and bearing his name. On behalf of the defendant, it was stated that some of the goods were not even tendered until November, after the action had been commenced; and plaintiffs therefore could not recover as for goods sold and delivered, but only as damages for breach of contract. The plaintiffs' traveller was told that defendant required the goods at once; and it was submitted that, as they were not delivered in a reasonable time, he was at liberty to reject them. Mr. Dunning was called, and stated that the first goods were not sent in until the end of July; and they were of no use to show—being only cheap lamps. Not one-sixth of the order was delivered by the 13th of August. The next lot was tendered on the 22nd; and he rejected the goods because they were too late. His Lordship gave judgment for the plaintiffs for the goods sold and delivered, and damages for those rejected. It was agreed between Counsel that these goods should be accepted and paid for; the plaintiffs to recover costs only on the County Court scale.

A Bogus Gas Engineering Company.

At the Surrey Quarter Sessions, on the 9th inst., before Mr. G. Cave and a bench of Magistrates, Sparshott West Field, *alias* Colonel Weston, *alias* Jenks, engineer, William Grimwood Brett, *alias* Captain C. Clarke, surveyor, and Henry Clifford Holden, commission agent, were each and severally indicted for conspiring and agreeing together to obtain by false pretences various sums of money by stating that they were the patentees and owners of the Castle gas-engine and other inventions, and also by representing themselves as the Castle Gas Engineering Company, Limited, merchants and exporters, consulting and mechanical engineers, with London offices in Queen Victoria Street and works at Kingston-on-Thames. Evidence was given to the effect that goods had been supplied to the accused, and that persons had been induced to part with money, on the strength of representations made that the Company was a genuine concern, whereas no such undertaking had been registered at Somerset House. A detective deposed that Field had already suffered imprisonment for similar frauds in 1885. He afterwards started the Albion Engine Company at Stoke, and absconded without paying his debts. He was then traced to Poole, where he did the same sort of thing. In 1891, he started the Vulcan Engine Works, and absconded with £125 stock and without paying his debts. The same year he opened the Crown Cinque Works at Southampton; and he again went to Poole and started the Atlas Engine Company—in each case getting goods, &c., by false pretences, and then absconding. He was next heard of at Gravesend, where he was made bankrupt and absconded to Twickenham, and next to Wimbledon, assuming the name of Colonel Weston—still obtaining goods by false pretences. He then removed to Kingston, and started the Castle Gas Engineering Company, obtaining goods from more than a hundred firms. Brett was an undischarged bankrupt; and the first record of him and Field working together was in November, 1894, when they were found getting money in respect of a colliery in South Wales. Field and Brett were found "Guilty;" and Holden, "Not guilty." The Chairman remarked that Field's career had been one of fraud and conspiracy all through; and he sentenced him to six years' and Brett to four years' penal servitude.

Liability for Water-Rates During Intermittent Supplies.

At the Basingstoke County Court last Thursday week, his Honour Judge Percy Gye had before him, at his first sitting, a case in which the Basingstoke Corporation claimed £1 12s. 4d. as water-rates from Mr. E. Andrews. Defendant had paid 19s. into Court, and contended that he was not liable to be charged from October, 1894, to June, 1895, because the supply during that period was so intermittent and at such low pressure that his household suffered great inconvenience. His Honour, in giving judgment for the Corporation for the balance due, ruled that their failure to give a sufficient supply—if failure there was—was no ground for refusing to pay the rate. The Corporation had power to make a rate founded upon the assessable value of each house served; and they had statutory powers to enforce that rate, even if the defendant had had no supply, or only an insufficient supply. His Honour granted leave to appeal.

Pretended Meter Inspectors.

At the Clerkenwell Police Court last Thursday, Albert Thompson, 21, a waiter, was charged before Mr. Bros with having been concerned with Walter Coley, already convicted, in obtaining 10s. by false and fraudulent pretences from Mrs. Emma Ward, of No. 25, Lucerne Road, Highbury Park. The circumstances under which Coley's conviction took place were reported in the "JOURNAL" at the time. Mr. Humphreys, who prosecuted for The Gaslight and Coke Company, stated that Coley had formerly been in the service of the Company as a fitter's mate. In January, 1894, the prisoner and Coley were living together in Camden Town; and they appeared to have conspired to defraud the customers of the Company. In this particular instance, they called at Mrs. Ward's house, and, representing that they were servants of the Company, they were allowed to examine the gas-meter. Mrs. Ward then complained that she had burnt more gas during the quarter immediately preceding; and Coley, having examined the meter, said there was a leakage. It was then suggested that the meter should be tested; and Mrs. Ward was induced to pay 10s. deposit for this to be done. Needless to say the

meter was not tested; and the next day an umbrella was missed from the hall, and a box of cigars from the dining-room. Evidence was given showing that the prisoner had no connection whatever with the Company. Detective Wilkinson said he arrested the accused as he left Pentonville Prison. He had been in gaol for robbing furnished apartments; the sentences being four terms of three months' hard labour. The offences were committed subsequent to the present charge. The prisoner now said he had been drawn into the frauds by Coley. It was a great surprise to him, when he was released from his long term of imprisonment, to find himself again arrested. He had decided to get a living by honest means. The father, who had been in business for himself for some years, now offered to find the prisoner work; and Mr. Bros, dealing with the case as one of larceny by a trick, accepted the father's bail for the prisoner's appearance for judgment if called upon.

Embezzlement by a Gas Collector at Stockport.

John Henry Hulse, late gas collector to the Stockport Corporation, was brought before the Magistrates at the local Police Court yesterday week, charged with embezzling the sums of £2 11s. 5d., £4 17s. 6d., and £5 11s. 2d., paid to him by gas consumers. Mr. H. Dobson, the Deputy Town Clerk, prosecuted. He proved the receipt by the prisoner of the amounts specified, and stated that these were not the limit of the sums he had not accounted for. Prisoner (who had been in the employ of the Corporation five years) pleaded guilty. He expressed great sorrow; but said the trouble had occurred through helping his brother, who was collector for the Cheshire Lines Committee. During the late Cheshire Lines frauds, his brother came to him in great distress, and said, if he (prisoner) would lend him some money, he would return it almost immediately. He had lent him £30. Replying to the Bench, Mr. Dobson said he could not tell how long the frauds had been going on; but, during last quarter, amounts to the total of £100 had been manipulated. Prisoner, on being questioned, alleged that he had speculated with the remaining money, in order to try to get the £30 back; and he added that the Guarantee Society who had paid the defalcations had distrained on his furniture. The Chairman (Mr. G. Nelstrop), in pronouncing the decision of the Bench, said that in consequence of certain facts which had come out in evidence in connection with the case, they had decided to deal more leniently with it than they otherwise would have done. Hulse would be committed to prison on three separate charges for terms of 14 days each, making six weeks in all.

[In a short comment on the case in the "Stockport Advertiser," it is stated that a new collector has been appointed who is to have a few pence over 30s. a week, and out of that is to pay the premiums to a Guarantee Insurance Society. It is, says our contemporary, this skin-flint system of paying the lower local officials which has introduced so many disagreeable abuses into local administration.]

The Chichester Corporation and the Water-Works.—For some time past, the relations between the Chichester Corporation and the Water Company have not been so agreeable as might be desired; the former body being of opinion that they should be accorded more favourable terms, in respect of water used for public purposes, than those offered by the Company. The Corporation went so far as to threaten to carry out a scheme for raising water in the Cattle Market for use in street watering and flushing. But this brought up an important legal question as to their right to do so. It is now thought that the present is an opportune time for coming to a settlement as to the control of the water supply of the city; and the Corporation have commenced negotiations with the Company with the view to the purchase of their undertaking. The price mentioned is about £45,000.

Arundel Gas Company.—The annual general meeting of this Company was held last Friday—Mr. C. Bartlett presiding. The report showed a further increase in the sale of gas and in the amount received for residuals. The price of gas was reduced 2d. per 1000 cubic feet from Jan. 1, 1895, and another 1d. from October last. The sum of £142 has been carried to the reserve fund, and £100 written off the suspense account, which is now closed. The works have been efficiently maintained, and the comfort of the men increased by the erection of a stokers' cabin. The following dividends were recommended: 10 per cent. on the original shares; 7½ per cent. on the £10 shares; and 5 per cent. on the £10 shares issued in 1892. The revenue account disclosed total receipts to the amount of £2769; and the balance to the credit of the profit and loss account stands at £1043; and the reserve fund, at £1131. The Chairman moved the adoption of the report and the recommendations contained therein; and the motion was carried unanimously.

Swansea Gas Company.—The annual meeting of the Swansea Gas Company was held last Friday week. The Chairman, in moving the adoption of the report and accounts, stated that the former showed a diminution in the gas-rental, which was owing to the very mild weather, to the depressed state of trade, and to the use of incandescent gas-burners. The number of works which had been closed in the neighbourhood of Swansea was, no doubt, a very disastrous thing for them; but he trusted that some new industry would spring up which would cause an increase in the business of the town. There had been a great falling of in the receipts from residual products, more especially in coke and sulphate of ammonia. The Directors had lately erected, with the consent of the Corporation, 100 incandescent gas-lamps, which consumed the same quantity of gas as the ordinary burners, but gave five times the illuminating power. The principal streets had been lighted, and had given general satisfaction to the inhabitants; and no doubt, if the Corporation desired to extend the system in different parts of the town, the Company would entertain the proposal. Carburetted water-gas plant had been put into operation during the last six months; and it was working very satisfactorily. The report and accounts were adopted; and the statutory dividends of 10, 7½, and 7 per cent. per annum were declared.

MISCELLANEOUS NEWS.

THE LONDON GAS SUPPLY BEFORE THE DISTRICTING ARRANGEMENTS OF 1860.

An Electric Lighting Company asking for Competing Powers.

Some interesting evidence as to the conditions under which gas was supplied in the Metropolis before the districting arrangements formally sanctioned by the Metropolis Gas Act of 1860 came into force, was given last month before the Select Committee of the House of Commons to whom was referred the Charing Cross and Strand Electricity Supply Corporation Provisional Order. Our readers, of course, are not concerned with the general evidence produced on this occasion, but only with that phase of the case presented to the Committee in order to induce them to refuse the competing powers asked for by the promoters of the Order. After the evidence on behalf of the promoters had been given,

Mr. Balfour Browne, Q.C., addressing the Committee in opposition to the Order, laid considerable stress on the fact that, though competition in gas supply was at one time very rife throughout London, the evils and inconveniences attending such a condition of affairs led to practically all the Gas Companies coming to an arrangement among themselves by which competition ceased; and this resulted eventually in the passing of the Metropolis Gas Act of 1860, which definitely allocated to each Company a particular district. The learned Counsel was able to point to the unvaried practice of Parliament during recent years, in refusing competing powers to either gas or water companies; and he instanced the provisions of the Public Health Act of 1875 (as affecting water undertakings) to show that more than twenty years ago the Local Government Board had determined that competition was not permissible so far as water undertakings were concerned. Speaking more particularly in reference to gas supply, he (Mr. Balfour Browne) emphasized some of the advantages that were soon manifest from the districting arrangements of 1860, and showed how in succeeding years the price of gas was reduced, until the "sliding-scale" and "auction clause" legislation of 1875-76 was initiated, since which period one uniform system of treating gas-works undertakings had been followed by Parliament. The learned Counsel concluded by saying that he intended to call two witnesses whom he hoped would convince the Committee that the Order under consideration by them was not a case where competition would be in the interest of the public, but one where it would be diametrically opposed to it.

Mr. *George Livesey* was then called, and examined by Mr. Balfour Browne. After stating that he was Chairman of the South Metropolitan Gas Company, but was not in any way interested in any electric lighting company, he said that he had been intimately connected with the gas supply of the Metropolis since 1848, and his father before him since 1821. He had therefore acquired large knowledge as to the history and conditions of the gas supply in London. The first of the London Companies was The Gaslight and Coke Company, established by Royal Charter in 1807. They first lighted old Westminster Bridge in 1813. In 1814, the City of London Gas Company was established; and in the same year, the Phoenix, or South London, Company was founded. These new Companies were not so much tempted by the profits made by the original Company, as by the prospective profits—they were "going to pay off the National Debt out of the profits made on gas." From these early times, competition became the rule. The companies mostly overlapped each other, though there were one or two—such as the old Independent Company—that were never subjected to competition. The result of their competition was to produce a low price for a time, but only for a time, because the principle laid down by the great George Stephenson—"I believe that where combination is possible, competition is impossible"—had been proved up to the hilt in the case of gas. It had always resulted ultimately in combination; and combination, coupled with regulation, had invariably ruled in the interests of the public. In most of the large provincial towns, there were formerly competing companies, evidence of which was found in the names of some of the companies still existing—the Sheffield United Company, Liverpool United Company, Bristol United Company, Alliance and Dublin Consumers' Company—showing that they all agreed not to compete at first, and ultimately amalgamated. Of course, all these Companies now carried on their undertakings under the regulation of Parliament. One of the early competitive companies in London was the Commercial, at Stepney; the chief promoters of which were publicans in the district. In his (witness's) early days, it was called the Publicans' Company; and it was formed because the promoters were dissatisfied with the supply of gas obtained from the old British Company. The Commercial Company soon absorbed the British—somewhere about the year 1850. In this year, two new competing gas companies were started in London—the Great Central, for the supply of the City, and the Surrey Consumers', for the supply of South London. Both of these Companies were founded with the distinct purpose of competing with the then established companies. At this time, the price of gas was 6s. per 1000 cubic feet; and that was the cause of the agitation. He (witness) had himself attended certain meetings in the Borough at which Mr. (afterwards Sir) John Thwaites, the Chairman of the Metropolitan Board of Works, presided. He advocated a reduction in price; but the Companies "were stupid and obstinate, and refused all concession." He considered that, if they had agreed to a reduction to 5s. per 1000 feet, there would have been no trouble. They, however, would not make any concession; and the two Companies were started, with the avowed purpose of reducing the price of gas by competition. They promised to sell gas at 4s. per 1000 cubic feet; and both of them did so for a time. In the case of South London, of which he (witness) knew most, the agitators secured quite sufficient promises from the consumers in the principal streets to take the gas from the new Company to justify them in starting. No sooner were they ready to supply gas, than the old Company brought their price down to 4s., with the result that a great many of the promises secured for the new supply were broken

and the new Company were in a difficult position for want of business. At that time, Sir John Thwaites certainly believed in competition; but he was afterwards one of the principal people interested in the subsequent districting arrangements. To his (witness's) knowledge, in some streets—the Walworth Road, for instance—there were four double sets of mains; the Phœnix, the London, the South Metropolitan, and the Surrey Consumers' Companies having all of them mains on each side of the road. In the Borough, the same state of affairs existed; while on the north side of the Thames, matters were even worse. In the Strand, for instance, four or five of the companies supplying gas north of the river had mains, with, of course, consequent exceedingly great inconvenience to the public.

Mr. BALFOUR BROWNE: Would you just tell me what happened when consumers were dissatisfied with one company.

Witness: They changed to the other; and they were dissatisfied about all sorts of things. If the collector pressed them for payment, they said: "I shall go to the other company;" and there was a great deal of rivalry between the officers of the respective companies. Men seemed to be more anxious to get business from a rival than to secure new customers; and they would frequently go to the consumer and say: "Your burners or fittings are bad. If you will change the supply, I will put in new burners, and do something for you." And these changes were constantly taking place.

Therefore it was not merely the inconvenience of altering and repairing mains, but even the service-pipes were always being changed and altered about?—Yes; every change necessitated the opening of the road—two openings to cut off one service-pipe and to connect another.

Examination continued: Of course, all this inevitably enhanced the cost of gas. The duplication of the mains increased the capital outlay; and this added to the charges on revenue. This state of things converted Sir John Thwaites; and he became an advocate for partitioning up London into various districts, each supplied by a separate company. South London was districted at Michaelmas, 1853—three years after the Surrey Consumers' Company started. The districting was done by mutual arrangement between the four Companies interested—the three older Companies gave between them an addition to the gas-rental of the Surrey Consumers' Company of £8000 a year. The following year, the four South London Companies promoted a Bill in Parliament to sanction their voluntary districting arrangements. Everybody was not, however, convinced as to the benefit of districting; and the Vestries opposed the Bill, with the result that on the first occasion it was promoted it was rejected. In 1857 and 1858, the northern Companies followed the example of the southern ones; and in 1860, the Metropolis Gas Act was passed for the purpose of regulating the Companies, and, among other objects, of legalizing districting. The Bill was promoted by the Metropolitan Board of Works, who thereby recognized the districting arrangements voluntarily come to by the Companies. All the districts were defined by a description in the Act of Parliament, and laid out in the map, which was subsequently signed by Mr. Sotheran-Estcourt, the Chairman of the Committee to whom the Bill was referred; and it therefore became the legal authority for the various districts.

Mr. BALFOUR BROWNE: I am reminded that the law officers have advised that the districting between the companies themselves, ceasing to compete, was illegal; and therefore it had to be legalized by an Act of Parliament.

Witness: I had forgotten that.

The law officers did advise to that effect?—It might have been illegal; but it was done.

It was illegal, there was no question; but it was a good thing. The Metropolitan Board of Works recognized it by introducing the Bill, and Parliament recognized it afterwards?—Yes.

Mr. MOON: And it would have to be done in the case of the electricity companies, if they combined.

Mr. BALFOUR BROWNE: It would likely lead to a similar thing.

Mr. MOON: They would require an Act of Parliament to combine, I mean.

Mr. BALFOUR BROWNE: No; I think they could combine without an Act of Parliament by this working union. As a matter of law, probably it might be illegal; as a matter of fact, it would be done.

Examination continued: The Gas Companies never thought of the legality or illegality of their proceeding; but in the end, what was done resulted in the interest of the public. The districting being effected, there was no going back from the arrangement, because the mains were all taken over; and, each Company having a district of their own, the whole of the mains in that district belonged to them. Mains unused were from time to time removed from the streets; so that at present there would only be two mains in each street—one on either side of the road. Though these would now be larger than the pipes laid during the competition period, there would still be only two; but the public had since the start had to pay interest on the capital expended on plant rendered unnecessary when the districting came into effect. He (witness) thought—though he had no interest whatever in electricity—that competition in electric supply was most undesirable. He believed that what was true as to the past of gas lighting, would inevitably be true in reference to electric lighting. A regulated monopoly in electricity, as in the case of gas, was, he considered, the proper course. Just in the district where competition ought not to be allowed, it was sure to be tried. In former times, the Surrey Consumers' Gas Company, for instance, did not canvass the sparsely inhabited or poor parts, but the great trading districts of the Borough and Newington. They left the private roads alone, merely endeavouring to get possession of the "fat districts." The result was that the busy roads were constantly being broken up, and not the streets in the outlying areas. Therefore it was in just those districts where the company would see their way to make a large profit that competition should not be allowed, but regulation should be enforced.

Mr. SHIRESS WILL, in cross-examination, referred witness to section 4 of the Model Provisional Order provided by the Board of Trade, which prohibited any authorized company within the administrative county of London to "purchase or acquire the undertaking of, or associate themselves with, any other company or person supplying energy under any Licence, Provisional Order, or Special Act." The learned Counsel, pointing out that the section gave power to the Board of Trade, in the event of any contravention of this provision, to revoke the Order, "upon such terms as they may think just," asked witness whether he was aware of this difference between gas undertakings and electric light supplies.

Witness said he was not aware of the distinction. He quite thought that prohibited amalgamation; but it would not prevent an agreement, if two companies were disposed to be friendly towards each other. There were various degrees and kinds of combination—some without a legal document of any kind whatever. Such an agreement as he contemplated would be merely one "not to compete." Under an arrangement of this kind, the companies would ultimately find that it was not to their interest to compete with each other; and finally they would come to an agreement, tacit or understood. Of course, with gas it would be competition with exact equivalents; but with electricity, there would be a difference between an alternating current and a continuous current supply. Another distinction might possibly be that extensions could, under certain circumstances—that is, when Callender casings were employed—be carried out for an electric supply without so much disturbance of the roads and streets as for gas-main laying operations; but he (witness) felt sure that in the City the Gas Companies would never have been allowed to do what the Electric Light Companies had recently done when laying their main cables.

Mr. SHIRESS WILL: Are you aware that Parliament in 1888 laid down the principle that the granting of a Provisional Order for the supply of electricity within any area, whether by Licence or Provisional Order, shall not in any way hinder or restrict the granting of like facilities to the local authority or any other company or person in the same area?

Witness: I suppose Parliament felt that electric lighting was in its infancy, and that, if they gave an absolute monopoly to any one company for the public supply of electricity, it would be, in effect, a prohibition of any improvements.

The Electric Lighting Act of 1882 (Mr. Chamberlain's Act) did not contain the provision providing for competition; so that Parliament, with six years' experience, had seen the wisdom of making such an enactment?—That is quite possible; but it does not follow that Parliament knew what was best at the time.

If Parliament did not know what was best at that time, it has now had another eight years' experience?—Well, we shall see what it will do now. Parliament is learning, like the rest of us.

Let me call your attention to a paragraph in Major Marindin's report after the inquiry instituted by the Board of Trade at the Westminster Town Hall in 1889. He said: "In the abstract, competition is desirable, as tending to keep down the price and to cause the manufacture and supply of electricity to be carried on with all the attention and energy which it is possible to devote to it." What do you say should guide the Committee in this conflict of opinion?—There is quite enough competition for the electric light industry, without competition with other electric light companies, to keep down the price. They have cheap gas to contend with and incandescent gas-burners, which give light for light at one-third the cost of electricity.

Major Marindin further says: "The competition with gas, which—at present, at any rate, and probably for many years to come—will appeal to a totally different class of customers, will not be nearly so effective; while the potential competition from the power of calling in a new company in an area badly served is not likely to be called into play until the bad service has passed through many degrees, and has reached a very low ebb indeed. The question as to how many companies should be granted concurrent powers in one area requires more consideration. In cases where the local authority objects to the entrance of any company, and it is decided to overrule the objection, I think that one company only should be granted powers. In cases where two or more companies have obtained the assent of the local authority, the following facts must not be lost sight of: First, that the laying of the mains of several companies up one street means so much dead capital, and, moreover, the provision of a certain amount of useless material, which the local authority would have to pay for if it should decide to purchase the undertakings after the lapse of 42 years. Second, that, no matter what regulations or stipulations may be made as to the laying of mains, the interference with the streets, and the consequent inconvenience to the public, must be in a certain degree proportionate to the number of companies having powers over the streets. For these reasons, I am of opinion that, for the present, powers should not be given to more than two companies over the same area; and, inasmuch as the companies supplying under the alternating current and transformer system cannot supply electric energy capable of use for motors, that both these companies should not be those using this system. In order, therefore, to leave room for the entrance of a direct supply company into an area where two alternating current transformer companies have been assented to, it will be necessary to choose one only of these companies; and this will lead to a certain amount of districting."—There is only one remark I should like to make about that statement, where Major Marindin says: "The competition with gas, which—at present, at any rate, and probably for many years to come—will appeal to a totally different class of customers." That, I think, is a mistake. There is no question whatever that the consumers are the same. Go along any of the great streets, and you will find that one shop has gas and another electricity, and private houses also. Those who have burnt gas, or might burn gas, are using electricity.

Cross-examination continued: I can only again express my belief that the end of any competition at present existing between the electric light companies will be combination; and, in the public interest, it is not advisable for any more companies to occupy the streets than are absolutely necessary. It is possible that there is at present competition in electric lighting in all districts of any worth; but those may be the very areas where it ought not to be allowed. I certainly look on the competition of gas with electricity as a powerful circumstance in keeping down the price of the latter.

Re-examined by Mr. FITZGERALD: The Board of Trade, when instructing Major Marindin to carry out his inquiry in 1889, recognized what I have been saying to the Committee, as to the grave inconveniences that arose in former years from the competition of the gas companies. The Board pointed out that it was "highly desirable to

avoid the grave inconvenience to which the public were subjected when there were competing gas companies supplying the same areas in the Metropolis." Major Marindin gave as his chief reason for suggesting competition that there is no competition between gas and electric lighting—that practically they appealed to different customers. Whether or not that was the case in 1889, it is not so now—more especially since the incandescent gas-burner has been introduced for shop and house lighting. Major Marindin's second reason was that, under the alternating system, it was not possible to supply electrical energy for driving motors; but this is not now the case, as I understand that as good a supply can be obtained from an alternating current as from a continuous current system.

Mr. *Corbet Woodall*, examined by Mr. BALFOUR BROWNE, said he agreed with the conclusions arrived at by Mr. Livesey, with reference to competition in gas. His experience was that regulated monopoly was better in every case in the public interest. In saying this, he was looking at the matter from the point of view not only of gas companies but also of local authorities, for a very large number of whom he was professional adviser. His (witness's) first experience in gas lighting was at Woolwich, where he was apprenticed. There were two companies competing for the supply; and the confusion between them was very great. The amount of gas that was left unaccounted for (allowed to leak, and not discovered) was very large. On one occasion at Woolwich, he remembered an accident which caused the lights in an extensive district to be put out one night; and it was discovered that, instead of all the consumers who were nominally supplied by the company at whose works the accident happened having their lights extinguished, a considerable number still burnt gas through being connected up to the wrong mains. Such an occurrence was caused by ignorant workmen going to make connections to mains belonging to different companies, but laid close together. The last surviving case of competition in the United Kingdom was at Edinburgh. So long ago as 1829, the Edinburgh Gas Company's Act was passed, which contained this provision: "That it shall not be lawful for the said Company at any time hereafter to join or connect themselves to or with any other coal gas light company already incorporated or that may be hereafter incorporated, nor to purchase or acquire any of the powers or authorities that may be vested in any such gaslight company or any part of the property of any such gaslight company, for the purpose of such junction or connection." This was to absolutely secure competition for all time; and it acted as a prohibition to any union between that Company and any other one. Section 13 of the same Act provided a series of limitations upon the Company, as to the amount of profit that might be earned, the inspection of the accounts of the Company, and so on. All these provisions were to operate so long as there was no competition; but the Corporation of Edinburgh deliberately gave up all these safeguards immediately after the passing of the Act, by granting permission to another company to commence supplying in the same district. This competition nominally continued until 1887 or 1888. In the meantime, however, the Companies had themselves found out the injurious effect of competition, and had agreed to an arrangement by which competition was limited. They districted themselves, in fact, and kept up this agreement until the undertakings were purchased by the Corporations of Edinburgh and Leith in 1888. In the investigations that took place in 1887, previous to the transfer, all the anomalies and disadvantages of the old competition were very fully brought out. He (witness) thought the action of Parliament had shown conclusively that in gas supply competition in the interest of the public had been a failure; and he did not see any ground for recommending it in the case of electricity. Judging from the precedent of gas, he thought competition would ultimately lead to combination, and meanwhile to the public inconvenience. At the time of the gas competition in London, the quantity unaccounted for amounted to more than 25 per cent. of the make. In Edinburgh, with the limited competition he had referred to, it was 11·8 per cent. At the present day, however, gas companies were ashamed to own to more than 6 per cent. Of course, in the times of competition, the public had to pay for the unaccounted-for gas, just as they have at present—that is, for 25 per cent., against 6 per cent. now. Beyond this, the consumers of gas in London were at present paying in the price charged for gas a considerable amount as interest upon capital wasted in the old days of competition. He said distinctly that, if Parliament had stepped in earlier and prevented competition, consumers would be paying less to-day for gas than they were.

Mr. SHIRESS WILL, in cross-examination: Did not the two Edinburgh Companies exist in competition for fifty years, till they were bought out a few years ago by the Corporations?

Witness: No; they existed nominally, but not as actually, competing companies. There was an arrangement between them as to the price to be charged, so that the competition was of no value whatever from that point of view to the consumers. They also agreed that in large areas of the city there should be no competition at all.

Do you agree with Mr. Livesey that Metropolitan gas is the same commodity, no matter what company supply it?—Yes; there are certain officials appointed called Gas Referees, three in number, who have instructions given them by statute, and who insist that the gas made shall come up to the required standard, which is a common standard for all the three Companies.

Mr. BALFOUR BROWNE, in re-examination: As to Edinburgh, you say there were fifty years of potential competition, but actually no competition at all?

Witness: For the later years, through the greater portion of it, no competition of any kind.

Reductions in Price.—The Ryde Gas Company have notified to the Town Council that, as from the taking of the indices for the past Christmas quarter, the price of gas would be reduced from 3s. 6d. to 3s. 3d. per 1000 cubic feet. As this will make a difference of £700 a year to the Company, a resolution was passed thanking them for their generosity. The Poulton-le-Fylde Gas Company have intimated to the consumers that, as from the 1st of July, the charge for gas will be at the uniform rate of 4s. 2d. per 1000 cubic feet, without the allowance of any discount.

DARLINGTON CORPORATION GAS SUPPLY.

Local Government Board Inquiry.

An inquiry was held at Darlington on the 11th inst. by Major-General H. D. CROZIER, one of the Inspectors of the Local Government Board, into an application by the Town Council for a Provisional Order to enable them to use a piece of land adjoining the existing gas-works for the purposes of extensions, and to borrow additional money for the undertaking.

The TOWN CLERK (Mr. F. T. Steavenson), in stating the case for the Corporation, said the rapid increase in the population, and the greatly increased demand for gas, made it absolutely necessary that the works should be extended. It was proposed within the next ten years to expend upon them a sum of between £50,000 and £60,000; and to meet what was expected to be the demand within the next two years would involve an expenditure of about £25,000. The consumption of gas in 1895 was 11½ per cent. more than in 1894. The present storage capacity was 978,100 cubic feet; and the manufacturing plant was only capable of producing 1,500,000 cubic feet per day, while the maximum day's consumption in 1895 was 1,223,500 cubic feet. He produced plans showing the piece of land proposed to be used for the erection of a new gasholder of a capacity of 1,250,000 cubic feet, and for other extensions. The cost of the piece of land in question was £625 per acre. The Corporation had exhausted their borrowing powers in respect of the gas-works, and required to raise £25,000 for immediate purposes.

Mr. *T. Smith* (the Borough Surveyor) then explained the plans in detail. He said there was at present only sufficient storage for three-quarters of a day's consumption; and to make provision for the next ten years, an expenditure of £50,000 would be required.

Mr. *J. W. Armitage* (the Borough Accountant) stated that the total cost of the gas-works up to Dec. 31 last was £105,263, of which £72,676 had been paid off, leaving £32,587 outstanding. The rateable value of the town was £164,631. Since 1878 and up to 1895, the department had paid £18,731 out of revenue for works which were really capital charges, in addition to the large amounts annually voted in reduction of rates.

Mr. *Charles Hawksley* was next called. He said he had inspected the land proposed to be acquired for the extension of the gas-works, and was of opinion that it was the only available site in proximity to the existing works. He had prepared a plan, showing how the site could ultimately be utilized. It was proposed to erect a holder with a capacity of 1,250,000 cubic feet. He estimated that to erect all the buildings needed, including the cost of the gasholder, machinery, land, &c., the Corporation would require from £60,000 to £70,000 during the next ten years. The holder would cost about £18,000. [A discussion arose as to differences in the figures; and it was gathered that the Borough Surveyor's estimate of £50,000 did not embrace the cost of meters, which were included by Mr. Hawksley, but which have hitherto been paid for out of revenue.] It was proposed, witness added, to erect the gasholder without delay. It would ultimately have three lifts; but only two would be constructed at first.

The INSPECTOR pointed out that the total sum mentioned in the memorial to the Local Government Board was only £45,000; and it was agreed to reduce Mr. Hawksley's estimate to £50,000—Major-General Crozier stating that he would ask the Local Government Board to insert that figure in the memorial.

The Inspector subsequently visited the site of the proposed extensions.

FATAL EXPLOSION AT THE HUDDERSFIELD GAS-WORKS.

On Saturday, the 11th inst., an explosion occurred in connection with the oxy-oil gas plant at the Huddersfield Gas-Works, which unfortunately resulted in the death of Fred Newman and serious injury to Alfred Goodall, two workmen in the service of the Gas Department of the Corporation. It appears that Newman was standing upon a platform above the retort-bench, not far from the pipe by which the gas is conveyed from the retorts to the condenser, when an explosion occurred, the force of which threw him to the ground—a distance of 10 feet. Goodall was watching an oil well at the time. The flames which followed the explosion attacked both men; Newman being terribly burnt. The Engineer and Manager (Mr. W. R. Herring) was quickly upon the spot; and, under his directions, prompt measures were taken to prevent further accident and to aid the injured men. They were removed to the Infirmary, where Newman succumbed later in the day. He was only thirty years of age, and had not been married many months.

An inquiry into the circumstances of the accident was held on Monday last week by Mr. J. E. HILL, the Deputy-Coroner; Mr. Eliot F. May, one of the Inspectors of Factories, being in attendance.

The TOWN CLERK (Mr. F. C. Lloyd) appeared on behalf of the Gas Committee of the Corporation.

James North, a foreman at the gas-works, said he was superintending the retort men at ten o'clock on the morning of the accident; and they were engaged in their usual occupation at the oxy-oil gas retorts when the explosion happened. He had only ten minutes previously been in the retort-house, and everything appeared to be right.

Mr. *W. R. Herring* said he was in his office when the explosion occurred, and immediately went to ascertain what was the matter. He saw a large quantity of smoke issuing from the oil retort-house, about 100 yards from his office. He immediately gave orders to cut off and isolate the retorts. When he reached the house, he saw two men being brought out; their clothes all burning. He gave instructions to other men to assist in smothering the flames; and preparations were made for removing the two sufferers to the Infirmary. He had investigated the cause of the explosion; and found there was apparently a defect in one of the iron retorts into which oil was run for making the oil gas. The defect appeared to be a porous blister, which, in his opinion, extended through the substance

of the iron; and this would have a tendency to draw in the hot air from the setting. This air, mingling with the oil gas in the retorts, would constitute an explosive mixture; and the hot air had been sufficient to ignite and cause an explosion. The plant was usually worked under pressure and vacuum alternately. The pipe conveying the gas from the retort was absolutely sound at the time of the explosion; and the force of this had torn it open. As far as they had been able to ascertain, the whole apparatus was in perfect order, and had been working so for several months past. The pipe was of steel, ⅛ inch thick, and had been tested up to 10 lbs. pressure. He had no reason to suppose it was anything but the explosion which caused the pipe to tear. The test for pressure was not made with the object of ascertaining the strength of the pipe, but to see if the rivets were tight, and the pipe gas-tight. They were always subject to these accidents; and they arranged to have a series of safety-valves which would act in case of anything going wrong. Had it not been that Newman was on the top of the retort-bench, he would have escaped with his life, the same as the others did who were below him. Had Goodall run in the reverse direction, he would not have been burnt at all. He really ran into the flames; but another man, who was nearer to the pipe, and ran the opposite way, was not hurt at all.

Mr. MAY: There is no possibility of any accident taking place unless there is a defect in the retorts and the gas explodes?

Witness: No. The retorts are examined from time to time—from two to four days—and when this retort was put to work the last time it was in its usual sound condition.

A JURYMAN: In your opinion, it was not anything the man was doing in connection with his work which brought about the explosion?

Witness: Nothing whatever. I can find no neglect on the part of the men. It was one of those defects which could not possibly be seen that caused the accident.

Witness produced a general plan of the retort-house, and the situation of the pipes.

Replying to the DEPUTY-CORONER, witness said it was oxy-oil gas that exploded, and it had not touched the coal gas. There was no more danger attending the making of gas by the oxy-oil process than by the ordinary method.

Medical evidence having been given to the effect that the cause of death was shock to the system due to the burns,

The DEPUTY-CORONER briefly summed up. He said the fatality seemed to have been the result of a pure accident. Every care appeared to have been taken to see that the works were in proper order. The retort was examined so recently as the Wednesday before the accident, and had been examined more closely since. After referring to the explanation given by Mr. Herring as to the cause of the accident, he asked the jury to consider their verdict.

After a brief consultation,

The FOREMAN said: We are of opinion, Sir, that there is no blame attached to the Manager or anyone else.

The DEPUTY-CORONER: I quite agree with you. Then the verdict will be that deceased died from shock, arising from burns, caused by the accidental explosion of gas at the Huddersfield Gas-Works.

The inquiry then terminated.

ELECTRIC LIGHTING NOTES.

A special meeting of the Lambeth Vestry was held last Thursday evening, to consider the electric lighting question. As the debate lasted nearly five hours, it would be impossible to give readers of the "JOURNAL" more than a brief epitome of the proceedings; but it will nevertheless be well to first touch upon the circumstances that rendered this meeting necessary. The Vestry have acquired a Provisional Order for lighting the parish by electricity; and on Sept. 5, 1895, they passed a resolution stating that they had no intention of surrendering the Order. On Feb. 6 of the present year, a Committee was appointed by the Vestry "to inquire into the proposals contained in the letters, dated Jan. 22, from Mr. Sydney Morse (on behalf of the County of London and Brush Provincial Electric Lighting Company, Limited) and from Mr. C. W. Sax, and to report thereon to the Vestry.' Briefly, Mr. Morse's proposal was that the Brush Company should take a transfer of the Vestry's Order, paying to the Vestry the expenses incurred by them in obtaining it, as well as the costs of the transfer. He also agreed to charge 7d. per unit at first, and to carry out the work in the two compulsory areas within a space of two years. Mr. Sax's proposal (the acceptance of which was subsequently recommended by the Committee) is noted below. The Vestry had also received a letter from the London Electric Supply Corporation, Limited, stating that statutory powers under the Electric Lighting Acts were already held for part of the parish by them, and that, despite their willingness and ability to supply current, and the efforts made, the demand was scanty—only 27 customers being obtained. Under the circumstances, it was urged that further competition could not be for the advantage of the ratepayers; whereas the Corporation would be glad to supply energy on a wholesale basis at a lesser rate than the Vestry could themselves do with their own generating station. The Committee held four meetings, and heard explanations from Mr. Sax and his Counsel, as well as from the representatives of the two Companies. At the last meeting, held on the 25th ult., it was resolved —"That the Vestry be recommended to transfer its Provisional Order to Mr. C. W. Sax, on the following terms: (1) That the supply of energy start at 6d. per unit, and be reduced not less than ½d. per unit for each 1 per cent. of dividend declared over 6 per cent. (2) That the Vestry have the right to purchase the undertaking at the end of 21 years or more, on payment of 25 per cent. over the statutory compulsory powers of purchase. (3) That the Vestry have the right to purchase the undertaking at the end of 31 years, on payment of the statutory compulsory terms. (4) That the works be commenced directly the transfer of the Order be executed, and completed within two years. (5) That £5000 be deposited with the Vestry as a guarantee of the completion of the works in two years." A Vestry meeting was held; and, after an angry debate, the further consideration of the recommendation was adjourned to the special meeting. In the interim, many meetings of the ratepayers, for and against the proposal, were held throughout the parish. The first business of the special meeting was to receive two deputations—one agreeing with the proposed transfer, and the other protesting thereat. The Ratepayers' Association organized the former; and a recently-formed body—"The Lambeth Municipal Electric Lighting Committee"—the latter. Mr. Stacy Gold and Mr. Boyd, the respective leaders, made telling speeches, and were severely "heckled;" and the debate then began in real earnest. Mr. Alderman Hubbard led the attack against the recommendation; urging that the Vestry should not give away what he considered to be a valuable concession. A long line of speakers followed; and the Vestry decided to rescind their resolution of Sept. 5, 1895—thus clearing the way for the plain issue. Then the main recommendation to transfer the Provisional Order to Mr. Sax was proposed by Mr. Williams; and a host of amendments followed. One of the latter was that the recommendation be referred back, and that the London Electric Supply Corporation, Limited, be empowered to proceed with the work; the expense of laying the mains alone to fall upon the parish. Another amendment suggested that the Order should be transferred to the Brush Company on payment of £1000. Eventually, both these and other amendments were defeated on divisions; and the closure was repeatedly applied—all to no purpose, however, for out of very weariness the vestrymen adjourned their consideration of the many amendments and the fatal resolution until that day week.

At last Friday's meeting of the Islington Vestry, a letter from a ratepayer was read calling attention to the uncertainty of the electric light in Seven Sisters Road, and requesting the Vestry to take steps to prevent accidents arising therefrom. This communication was, amid laughter, referred to the Electric Lighting Committee with power to act. Another interesting letter was from the London and County Bank, asking that the seal of the Vestry be affixed to the overdraft of £30,000 on the electric light account—and so soon, too! Then came a recommendation of the Electric Lighting Committee that "an expenditure not exceeding the sum of £2000 be sanctioned for the purpose of purchasing the necessary distributing plant required to enable a supply of electricity to be given to the Royal Agricultural Hall and to the Northern Polytechnic Institute, and other premises adjacent thereto, in order to fulfil the terms of the contracts entered into with the proprietors of these establishments." This was moved by Mr. Lambert, the Chairman of the Committee, and resulted in a lengthy debate; an amendment being proposed by Mr. Varley asking for fuller details as to whether or not a part or the whole cost could not be charged direct to those establishments. Mr. Dryden inquired where the money was to come from. Already, he said, the account was overdrawn by £30,000, and now another £2000 was wanted. Mr. Goodman maintained that this £2000 was by no means part of it; and the bank would be very glad to lend the money to the Vestry. The amendment was lost, and the original motion carried. A large extension of the system was subsequently agreed upon.

The Exeter Corporation have arrived one step nearer the realization of their ambition to acquire the local electric light undertaking. At the meeting of the City Council last Wednesday, a letter was received from the Local Government Board, sanctioning the raising of a loan of £7500 for the purchase of the undertaking on the Board of Trade consenting to the transfer from the Company to the Corporation. The Board of Trade have expressed their readiness to consider an application for the revocation of the Order granted to the Company in 1891, upon being satisfied that the necessary preliminaries have been complied with. Nothing, therefore, now stands in the way of the early realization of the Corporation's wishes. It is felt, however, that the period allowed for the repayment of the loan is short, though, having regard to the low valuation placed upon the works by the experts who had been consulted by the Corporation, this is not very much to be wondered at.

Last Wednesday, Major P. Cardew, R.E., held an inquiry, on behalf of the Local Government Board, in regard to an application made to them by the Bangor City Council for a Licence to supply electric energy in the town. The project has aroused the strongest opposition on the part of the ratepayers; nevertheless, the majority on the Council have pushed the matter forward in every possible manner. The Bishop of Bangor, Lord Penrhyn's Manager, and others, stated that they would take a supply of electricity if it were available; and the Chairman of the Electric Lighting Committee (Dr. Edwards) said that what were practically definite promises to adopt the light had already been received to the extent of 3000 lights. Mr. Griffith, representing the objectors to the scheme, said that, both in numbers and in rateable value, the majority of the ratepayers were opposed to it. On the Council, the numbers in its favour were 14, and against it 10. But whereas the 14 only represented a rateable value of £700, the 10 represented a rateable value of £12,000 in respect of property actually occupied by themselves, not including property owned. A petition against the scheme had been signed by more than 1000 burgesses, and sent to the Board of Trade. He called the attention of the Inspector to the facts that the rateable value of the town was £36,400, while the liabilities were £117,000, besides power to borrow a further sum of £10,000; and the rates were about 8s. in the pound. Alderman T. Lewis, the Chairman of the Water and Gas Committee, gave evidence against the application. He said that, to his mind, it was inconceivable that the proposed scheme could be anything but a failure. Mr. J. Smith, the Manager of the gas-works, said that if a gasholder 100 feet in diameter were provided, it would serve the town for the next ten years, even granting that an increased consumption of 20,000 cubic feet of gas took place every year. Mr. J. E. Roberts, the Mayor of Bangor, also gave evidence against the application, and expressed the view that the proposed expenditure upon the present works would be quite sufficient to supply the town for the next ten or fifteen years. Mr. T. J. Williams said there were 1035 signatures attached to the petition presented to the Board of Trade against the scheme; and he had 35 more to add. The total number of ratepayers on the burgess list was from 1800 to 1900. He put in a petition, signed by ten members of the Council, against the scheme. The inquiry ended with a vote of thanks to the Inspector.

METROPOLIS WATER SUPPLY.

Conference of Local Authorities—Proposed Supply of Sea Water.

Last Tuesday, a conference took place at the Marylebone Vestry Offices for the purpose of considering whether the existing water supplies may not be so economized as to render unnecessary any costly scheme for an additional service of potable water, and also the desirability of bringing sea water to London. Mr. Hopkins presided; and he pointed out that the Government had introduced a Bill dealing with the water supply by means of a Trust, so that, in a great measure, they might look upon the scheme to which they were going to ask them to object as practically dead. A great amount of time had been expended in preparing that scheme; and it might crop up at any moment, because the County Council would have a majority on the Trust, and probably they would try to carry the scheme. Although all the Royal Commissions had dealt with the question of the increased supply of water, none appeared to have thought about economizing water. He had made a suggestion that the streets should be watered and the drains flushed by water from the tidal portion of the river; and he now put forward the suggestion that a supply of sea water might be used for sanitary purposes. He moved—"That this conference, having in view the report of the Royal Commission on the Water Supply of the Metropolis (1893), is of opinion that the scheme recommended by the Chief Engineer of the London County Council for bringing water from Wales, at an estimated cost of nearly £39,000,000, should not be proceeded with until proper inquiry has been made as to what economy of the existing supply could be effected by using unfiltered or sea water for sanitary purposes, and the probable cost." Colonel Barchard seconded the motion. After some discussion, in which a number of objections were urged to the use of sea water on the roads and in the drains, Mr. T. W. Grierson, the Engineer to the proposed Sea Water Supply Company, said that the maximum charge to be inserted in the Bill was 5s. per 1000 gallons; but there was no intention of going as high as that. Mr. Collard moved an amendment to the effect that no scheme should be undertaken without proper inquiry as to what economy of the existing supply could be effected by using unfiltered or sea water for sanitary purposes; and this was carried. The Chairman then moved: "That it is desirable to bring sea water to London for sewer flushing, street watering, and other purposes; but that such undertaking should be in the hands of a public authority, such as that recommended at the recent conference of Local Authorities held at Kensington to take over the present Water Companies." Mr. Wildbore moved, as an amendment, that the resolution should approve of the introduction of sea water if found desirable, and that the undertaking should be in the hands of a public authority directly elected by the ratepayers. Mr. Collard seconded the amendment, which was carried, after some discussion. Finally, a further amendment was carried, simply declaring that it was desirable that sea water should be brought to London, and this was then agreed to as a substantive resolution. The Chairman moved—"That should the Water Companies' interests not be purchased, an obligation be imposed upon the Companies to reduce their charges, in the event of the scheme for bringing sea water to London being carried into effect, as regards those premises supplied therewith." This was agreed to without discussion. It was moved on behalf of the Camberwell delegates—"That, in the opinion of this Conference, the water supply of London should be under the control of a body directly elected by the ratepayers, and not in the hands of private companies." This resolution was also adopted without debate. The proceedings then closed.

PAIGNTON WATER SUPPLY.

A large increase in the storage of the Paignton Water-Works was formally inaugurated on the 9th inst. The first reservoir had a capacity of little more than 2 million gallons; but this was subsequently enlarged to 3 million gallons by raising the bank a couple of feet. This, however, proved wholly inadequate to meet the increasing demand; and the District Council have now built a new reservoir with two additional filter-beds—increasing the storage capacity to 12 million gallons. The work has been carried out from the designs and under the superintendence of Mr. J. Newton, M.Inst.C.E., of Manchester, who at the inaugural ceremony gave a description of the work. He explained that the whole of the water in both reservoirs sprang from the bottom of the original reservoir, and issued from the Devonian rocks below. None came from the streams adjoining; the overflow from the old reservoir having filled the new one. The new reservoir held roughly between 9 and 10 million gallons. Two new filter-beds had been constructed equal in size to the two which they previously had. He estimated that they could safely take through them 200,000 gallons per day. From the filter-beds the water went into a large covered reservoir adjoining, capable of holding 100,000 gallons. The old service reservoir only contained about 50,000 gallons. Thence the water ran into a 9-inch pipe, right under the bottom of the new reservoir, and connected with the 6-inch main into Paignton. He felt that this main was not large enough, and that it would be wise at some future time to replace it by a 9-inch main. The stream which ran down the valley was conveyed past the reservoirs in a 24-inch pipe down into the old stream below. There would be no great difficulty in turning this into the town mains if it was wanted; but he should never recommend its use if they could get spring water, which was infinitely better. The works were formally opened by the Chairman of the District Council (Mr. J. Parnell), who turned the water into the new filter-beds. At a dinner which was held subsequently, Mr. Newton made further reference to the works, and said these had been carried out at a cost of about £6400.

The Recent Concessions to Leeds Gas Workers.—The Leeds branch of the Gas Workers' Union still adhere to the opinion that the just claims of the men have been but inadequately dealt with by the Corporation Gas Committee; and the officials consider they are entitled in the near future to again press their claim for increased wages for those men whom the Committee have at present ignored. The concessions already granted will take effect from next Friday.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Informal Meeting of Scotch Gas Managers was held in Glasgow last Wednesday, and proved a great success, both in point of the numbers attending and the quality of the proceedings, particularly of the address of the Chairman (Mr. A. Bell, of Dalkeith). What struck me as the most distinguishing feature of the meeting was the almost entire disappearance of the outward semblance of informality which used to characterize the gathering. In the first place, except the few remarks which were made regarding the Forfar explosion—a subject which was specially introduced—the whole of the discussion took place upon the Chairman's address; whereas the practice used to be for speakers to bring forward any subject which was of interest to them. There might have been reason for this, in the fact that the Chairman's address was a heavy one, and raised questions of great importance; and also in the fact that, to all intents and purposes, the Peebles process of enrichment still, so far as Scotland is concerned, holds the field as the only new process worth considering. The other features of the meeting which marked a departure from informality were the absence of the customary refreshments during the proceedings. Then, further, for the first time, a note of the proceedings was taken on behalf of the North British Association of Gas Managers. Manifestly the meeting - and I am pleased to see it—has passed its nebulous stage, and has become a concrete body with a place in the constellation of gas managers' gatherings, now one of the brightest in the scientific heavens. In that constellation it has an orbit, and its path—again I am pleased to see it—is towards a closer union, with probably ultimate absorption in, or affiliation with, the North British Association. This will most likely be a matter of time. It is gratifying to see that the two meetings have no rivalry between them, but that, composed almost entirely of the same gentlemen, they recognize each other, and practically do the same work. The silent movement which is at work will, it is to be hoped, only accentuate that feeling, whether or not it goes the length of my forecast.

As I have said, the Chairman's address was a weighty document, and provided sufficient material for the whole of the discussion which followed. The subject was that expressed alike by the terms "illuminating power and illuminating effect," and "high-grade against low-grade gas;" but which is really the question of enrichment or non-enrichment. In Scotland, there is another sub-division—viz., whether the enrichment should be by cannel or by oil. The preponderating opinion is that high-grade gas should be supplied, which means enrichment by some process; but there is a sharp distinction as to which of the two classes of processes it shall be. Those who have adopted the oil process—that is to say, the Peebles process, for there is no water-gas process at work in Scotland at the present time, and neither water gas nor any other oil process was mentioned—are enthusiastic over the results they obtain by it. Mr. J. M'Crae, of Dundee, did make an asseveration of his doubt whether all who had "experimented" with oil were quite satisfied with their results. No one, however, who had experience expressed any doubt; and so it must be taken that all are satisfied. It will be observed that Mr. M'Crae only referred to experiments with oil; and so he cannot be held to have referred to the Peebles process, which is no longer an experiment. It is true that even with it experiment has been tried, but without good results; the fact being that, like all other processes, unless it be worked according to the instructions of the inventor, it might as well not be adopted. While the oil-process men are confident that they are working on the right lines, there is a strong contingent who hold by cannel as the cheapest and best enricher. The difference between the two divisions was most sharply brought out in the passage between Mr. T. Wilson, of Coatbridge, and Mr. A. Yuill, of Alloa, as to the cost of enrichment by oil; but as they seemed not to be able to arrive at a satisfactory basis of comparison, a solution of the question of which would be cheapest was not approached—the cost of enriching by coal not having been once mentioned. Mr. A. MacPherson, of Kirkcaldy, was certainly right when he said that the question was all one of circumstances; and there it must rest.

On the subject of illuminating power as against illuminating effect, the discussion could not have been expected to lead to great results, seeing that the leading scientists in the gas industry are divided upon it. Mr. A. Wilson, of Dawsholm, made the most significant contribution to the discussion on that point; but as he asked his hearers to make experiments, he could not be replied to on the spot. By all means let experiments be made by individual gas managers; but no amount of such experiments will solve the real question at issue, which is whether the best illuminating effect can be obtained from high or from low grade gas. An individual manager might arrive at important conclusions as to the best method of burning his own gas; but he could never settle the general question. To do that, much more exhaustive tests would be required than any single manager—with only one quality of gas at his command—could make. But in any experiments, it should not be forgotten that the subject divides itself into two—viz., the amount of light, and the effect produced. The first may be called the workable light; the question being the relative quantities of the different gases which would require to be burned to give the same light at certain distances—light which would enable work to be performed at those distances. This could easily be determined by the exposure of sensitized papers. It is the other which is the complex question, because the effect which will be produced by the burning of different gases depends upon so many considerations. One quality, or strength, of light might be required in a church, and another in a ball-room or theatre, according as it was desired to show forth the personal or architectural decorations; while quite different lights might be needed in sale-rooms, workshops, or domestic apartments. Over all these conditions, too, would rule the visual capacity of the proprietor or conductor of the place. So that, although general rules might be laid down by one eminent person, or body of persons, as to what would be the correct mode of lighting to give the best effect in different places, it would be impossible, so long as eyesight varies, to obtain general assent to those rules. The question of illuminating effect in that sense is too personal to be ever solved satisfactorily. In the other sense, the question is a

scientific one, and may be solved any day by anyone who likes to undertake the trouble and the cost.

A good deal of discussion of an irrelevant nature took place over the permanency of oil gas. It is a pity the subject was not rightly dealt with; but it was confused by the begging of the question, as I should call it, on the part of those who put forth that oil gas could be no more permanent than coal gas. Of course, that assertion is correct. All gas is permanent, if it is gas. But, while in the case of oil gas, as manufactured by the Peebles process, nothing but permanent gas can get past the washer—as is well known in all except the one or two happy places, where the traps are never pumped—coal-gas plant, as usually constructed, does pass, along with the gas, vapours which condense. With sufficient condensing power, coal gas could be made thoroughly permanent; but, on the one hand, that would mean costly additions to plant, whereas with the oil process no addition to plant is necessary to produce permanent gas, and, on the other, it may be advisable, in the case of coal gas, to send out condensable hydrocarbons, in the hope that some of them may reach the burners, and so keep up the illuminating power. The difference between the two gases is thus strongly marked. In the case of oil gas, the more it is washed the higher is the illuminating power; while with coal gas, effective washing may, and does, lead to a lowering of the illuminating power.

The only other subjects worthy of mention were the Forfar accident, discussion upon which was wisely suppressed, in view of the subject coming before the Forfar Gas Corporation at an early date; and the steel standard meter-unions, which, it was explained, were not before the meeting at all, but were merely there for the purpose of being looked at before and after the meeting. They were looked at; but opinion upon them has not yet crystallized, and cannot be stated. They are, however, very beautiful pieces of workmanship.

The Edinburgh and Leith Gas Commissioners held a meeting on Monday, at which the coal, lime, and other contracts for the year, were agreed to. With regard to the coal contracts, Bailie Kinloch Anderson stated that some alteration had been made upon the lists submitted; so that it will be better not to give the contract price in the meantime. The lime contracts were agreed to as submitted. These consisted of 5000 tons for the Edinburgh works, at an average price of 11s. 5·1d. per ton; and 2650 tons for the Leith works, at an average price of 11s. 5d. per ton. The only other business of any consequence before the Commission was a recommendation by a Sub-Committee of the Works Committee that the Commission might consider whether it would be expedient for the Scotch corporations owning gas-works to combine in making meters for themselves, and so break up the ring among makers; and that the engineers should be instructed in future to obtain tenders in duplicate, and to report the amount of every offerer's tender for each item, calculated on the previous year's requirements. This recommendation appears to be the offspring of one of those mischief-makers who, possessing a little knowledge, imagine they are masters of the whole subject; but it is satisfactory to know that the absurdity of it did not escape the eagle eye of Bailie Kinloch Anderson. He was not, he said, present at the Sub-Committee meeting; and he asked that the subject should be sent back to the Works Committee to consider. This was agreed to; and the sapient one will in all probability find that he has "hoisted a kite which will not fly."

The large new gasholder at the Tradeston gas-works of the Glasgow Corporation is advancing satisfactorily. The tank has been completed; and the contractors for the holder—Messrs. Clayton, Son, and Co., Limited, of Leeds—have erected the bottom lift, and are about to begin the first lift. With prompt deliveries of material, the holder should be in readiness for use during the next lighting season. The Corporation have now 12,737 gas-stoves on hire.

The Corporation of Renfrew have let a contract for the erection of a two-lift gasholder, on the site of an existing holder, to Messrs. Hanna, Donald, and Wilson, of Paisley, at the price of £645.

At the Perth Gas Commission, on Monday, it was reported that the feet; and that the output in March exceeded that in the same month of last year by 731,500 cubic feet. In connection with the tenders for the quantity of gas made since April 30, 1895, had been 108,522,000 cubic supply of oil, attention was called to the circumstance that one of the offers had been received after the other tenders had been opened. It was pointed out that the acceptance of the new offer would mean a saving of £50; but Lord Provost Dewar rightly replied that, though they were to save that sum, they would lose their reputation. The new offer was rejected, as it ought to have been; and the Works Committee were directed to accept the next lowest tender.

The Corporation of Edinburgh are promoting a Bill in Parliament for the extension of the city, so as to include Leith, Portobello, and a portion of the County of Mid-Lothian. Though they should acquire Portobello, there is a Gas Company there which they must come to terms with, as that burgh is at present declared to be beyond their area of supply. This week the Corporation met, and considered this and several other subjects in private; and it has been given out that they have resolved to come to terms with the Portobello Gas Company, though the mode in which the agreement is to be arrived at is not stated.

The Brechin Police Commission have, in pursuance of their proposal to acquire the undertaking of the Brechin Gaslight Company, resolved to ask the Company to assent to their appointing experts to value the works. We shall see if the permission is given.

At the meeting of the Peterhead Police Commissioners on Monday, the Committee reported that they had agreed that the price of gas for cooking, heating, and motive power should be 4s. 6d. per 1000 cubic feet, which is 3d. less than last year, and 10d. less than is charged for gas for lighting purposes. The Commissioners, it was explained, have found that, by reducing the price of gas for these purposes, they have encouraged its use, and that the quantity of gas so used had increased last year from 706,000 to 1,153,000 cubic feet.

At the meeting of the Broughty Ferry Police Commission this week, it was suggested that the Gas Committee should see to it that a higher quality of gas should be given; the illuminating power to be not less than 27 candles. Mr. Hood, who brought forward the subject, said that a year or two ago the gas which was supplied was superior to that manufactured now, and was really cheaper in the end to the consumer. The subject was remitted to the Committee, which was perhaps the quietest way of shelving a man who grumbled without giving proof of the ground of his complaint.

The prepayment meter trade has been one of great activity in Edinburgh during the past winter. The makers have been running their works till 10 o'clock, instead of closing at 5 p.m., since last autumn. Now, however, the demand has eased off; and the late hours have been given up.

On Monday night, the Falkirk Gas Commissioners met and considered the recommendation by their Works Committee to enter into a contract for the erection of a columnless gasholder. Bailie Hamilton, the Convener, in moving the adoption of the recommendation, said that the site which they had chosen was on scheduled ground at Bleachfield. It was not the most suitable; but if they had adopted another site, they would have required to go to Parliament for powers to use it. They had visited England, and were thoroughly satisfied with the holder they saw at Middlesbrough, where the Manager had told them that he was not at first in favour of rope-guided holders, but that, after eighteen months' experience of one, he would not care to have any other. The holder which they proposed to erect at Falkirk would, on account of the site, be entirely above ground—tank and all. He moved that the offer of Messrs. Ashmore, Benson, Pease, and Co., Limited, of Stockton-on-Tees, to erect the holder for £6722, and to guarantee it for five years, be accepted. This, after some discussion, was agreed to. The holder is to be in two lifts—of 132 and 130 feet diameter respectively. It is expected to be ready in October. By erecting the tank above ground, and dispensing with columns, it is anticipated that a saving of about £1600 will be effected.

The Corporation of Glasgow, on Thursday, agreed that the new reservoir at Craigmaddie should be opened by Councillor Osborne, the Convener of the Water Committee, on June 11. Mr. Osborne, it appears, has been 34 years a member of the Corporation, having been elected in 1862; and he is the oldest member. In recognition, therefore, of his services to the community, the Water Committee proposed that he should be presented with his portrait. Even such a reasonable proposition as this was opposed; and on the ruling of the Town Clerk (Sir James Marwick) being taken, he laid it down that the Corporation could only expend money on objects which the Acts of Parliament sanctioned. All the same, it was resolved to make the presentation; the cost of the portrait to be defrayed, if necessary, out of the Common Good, to which no statute applies.

The Burgh of Carnoustie has found it to be an expensive matter to procure a sufficient supply of water by boring and tunnelling underground; and this week the Police Commissioners resolved, by the casting vote of the Provost, to apply to the Dundee Water Commissioners for a supply from their reservoir at Crombie, to be used to supplement the water from the well. The Works Committee of the Dundee Water Commission were approached on Thursday; and they agreed to give a supply of 10 million gallons for £250 a year—which is at the rate of 6d. per 1000 gallons—with the stipulation that whatever water over this quantity was taken, should be charged for at the rate of 4d. per 1000 gallons. The Police Commissioners of Carnoustie will require to lay the piping. This offer has yet to be communicated to the Police Commissioners.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *April* 18.

Sulphate of Ammonia.—Notwithstanding the anomalous position of sulphate prices compared with those of nitrate of soda and other nitrogenous material, and also the large increase in exports—about 10,000 tons up to the end of March—a further decline in values has to be recorded. For some weeks past, the Scotch makers have been the most anxious sellers; but during the past week, London has been competing more closely, and other ports are being forced into line. At the close, the quotations are £7 15s. f.o.b. Leith, £7 16s. 3d. f.o.b. Hull, and £7 17s. 6d. f.o.b. Liverpool. The demand for home consumption is well sustained; but there is still a marked scarcity of direct orders from consumers abroad; the export buying being mainly by dealers to cover speculative sales for April delivery. In the forward position, there has been more doing. Makers, who for the most part have hung back hitherto, have come out as sellers ahead; and business is reported to have been done at £8 5s. to £8 10s. per ton, according to position.

Nitrate of Soda is barely steady; there being sellers on spot at 7s. 10½d. to 8s. per cwt., according to quality. For cargoes afloat and for shipment, quotations are unchanged; but dealers are venturing to sell ahead at a very small premium upon spot values—depending upon ample supplies to pull them safely through.

LONDON, *April* 18.

Tar Products.—There is very little heart in this market; and, in most articles, buyers are talking prices down, and appear to expect lower rates as the season advances. This particularly applies to benzols, which are as dull as they well can be. However, there is very little offering; and, as the season for short production is now rapidly approaching, manufacturers will be foolish to press sales. Solvent naphtha is in steady demand; but no new business of importance is reported. Pitch continues dull; and buyers are holding off in the meantime. Stocks of pitch in this country are extremely light; and there is no substantial reason why this article should see a fall. Pressed naphthalene is more saleable; and somewhat better prices are now offered. Anthracene is well held; and there is very little offering. Prices are not only likely to be maintained, but possibly advanced. There is a large decrease in the stocks of anthracene held in this country.

Average prices obtaining during the week are: Tar, 19s. to 23s. 9d. Pitch, 30s. to 32s. 6d. Benzols, 90's, nominal, 1s. 10s. to 2s.; 50's, 1s. 7½d. Toluol, 1s. 5d. Solvent naphtha, 1s. 3d. Crude, 30 per cent., naphtha, 9½d. Creosote, 1d. Creosote salts, pressed, 52s. 6d.; drained, 30s. Cresylic acid, 1s. 1d. Carbolic acid, 60's, 2s. 1½d.; 75's, 2s. 4½d. Anthracene, "A," 10½d.; "B" quality, 8d. to 9d.

Sulphate of Ammonia continues in a bad way. Large sales for forward delivery have been made at £8 per ton; and the singular position of nitrate of soda being worth as much as sulphate of ammonia

is being maintained, notwithstanding that there is 25 per cent. difference in the nitrogen value of the two. London £7 17s. 6d. to £8 has been taken; while £7 15s. is reported as the price at Leith, and £7 16s. 3d. at Hull; and Bristol, Liverpool, and Glasgow, and other west coast ports, £7 17s. 6d. to £8. These prices are, of course, less 3½ per cent. Gas liquor is offered at 5s. 6d. to 6s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The coal trade here remains without material change; business generally continuing slow, with extremely low prices ruling. Pits on the average are only working about four days per week; and even with this limited production, the supplies offering on the market are in excess of the demand—so far, at least, as round coals are concerned. In the better sorts, suitable for house-fire requirements, there has been a fair business doing, with the cooler weather; and prices are generally steady at late rates, though for quantities rather lower figures would be taken. Steam and forge coals are in but slow request, and special concessions are made. Prices are cut to a very low point to effect clearances; and for ordinary business the competition is exceedingly keen. Engine fuel meets with a ready sale; and there is rather a scarcity of supplies in some of the better qualities. Prices consequently show an upward tendency; and though it is exceptional where the attempts to secure advanced rates have met with any appreciable success, a very firm tone is maintained at late rates. At the pit mouth, best Wigan Arley average about 10s. per ton, with a concession on this figure where sales of any weight are in question; Pemberton four-feet and seconds Arley, 8s. 6d. to 9s.; common round coals, from 6s. up to 7s., according to quality; and engine fuel, from 3s. and 3s. 6d. for common, to 4s. and 4s. 6d. for better descriptions. For shipment, business continues very limited in weight, with no better prices obtainable. From 6s. 9d. to 7s. 3d. per ton are still about the average figures for common steam coal, delivered at the Garston Docks, the High Level, Liverpool, or the Partington tips of the Manchester Ship Canal.

Northern Coal Trade.—There has been in the past week a better demand for steam coal; and a further improvement is expected in the next fortnight, when it is anticipated that the shipments to ports in the North, which take large quantities of coal, will commence for the season. The better demand has enabled most of the steam coal collieries to work fuller time. The price is also firmer, but not quotably higher, at 7s. 9d. per ton f.o.b.; while steam smalls are not quite so scarce as they were, the fuller working of some steam collieries giving a better supply. The price is still about 3s. 6d. per ton. There is no alteration in the demand for manufacturing coal; and the price is unaltered. In the gas coal trade, the demand is now, for home consumption, rapidly falling to its lowest level; but there is a decided improvement in the quantities that are being sent forward for export. Generally, the price is now 6s. 6d. to 6s. 9d. per ton f.o.b., for occasional cargoes; though one or two producing firms ask higher prices. The tendency to close collieries that are losing, will in time rather stiffen the prices. In coke, there is a strong home demand, and a rather fuller inquiry for export. For shipment, the price for best Durham kinds of coke is 15s. to 15s. 3d. per ton f.o.b.; and for home consumption, the price is about 13s. 6d. to 13s. 9d. per ton at the Teeside blast-furnaces. Gas coke shows no alteration this week.

Scotch Coal Trade.—The situation remains unchanged; the output being large, and prices the same as last week. Splint is, if anything, in less demand; but other varieties are moving off freely. The prices quoted are: Main, 5s. 9d. per ton f.o.b. Glasgow; ell, 6s. 3d. to 6s. 9d.; splint, 6s. 3d. to 6s. 9d.; and steam, 7s. 6d. The shipments for the week amounted to 114,878 tons—a decrease of 50,392 tons on the preceding week, and of 27,090 tons on the corresponding week of last year. For the year to date, the total shipments have amounted to 1,750,659 tons—an increase over the same period of last year of 114,353 tons.

Gainsborough Water-Works.—Since our last reference to these works, which were commenced by the late Mr. Jabez Church, and are being completed by his partner, Mr. Percy Griffith, the first portion of the large boring has been successfully completed. It is 320 feet deep and 36 inches in diameter, and is lined with 30-inch wrought-iron tubes, the annular space around which is filled with fine sharp sand and iron borings to one part of Portland cement. The last lengths of the tubes were lowered on the 10th ult.; and, after they were carefully tested for verticality, the cement was filled in behind them till it finished off level with the top of the last tube. As the boring was so much larger than the tubes, the whole weight of the 290 feet of tubes (upwards of 18 tons) had to be suspended on the overhead gear. Ample precautions were, however, taken by the contractors (Messrs. E. Timmins and Sons, Limited); and the whole of the operations were conducted without mishap or accident of any kind. The next section of the boring is now in progress, and is being bored 24 inches in diameter. If it is found possible to continue this to the total depth required to be tubed (another 440 feet) without any difficulty from infall, &c., the whole of this section will have 18-inch tubes lowered into it, and be filled in with cement as in the first section. This boring is to be carried down to a total depth of 1450 feet, and is to finish not less than 18 inches diameter at the bottom; so that the endeavour to avoid any driving of the tubes by the system described will be fully appreciated by those who are experienced in boring operations.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST (see ante, p. 854).

Issue.	Share.	When Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	15 Apl.	10½	Alliance & Dublin 10 p. c.	24½–25½*	+1	4 2 4
100,000	10	,,	7½	Do. 7 p. c.	17–18†	+1	4 3 4
300,000	100	2 Jan.	5	Australian (Sydney) 5% Deb.	108–110	..	4 10 11
200,000	10	16 Oct.	4	Belgrano (B. Ayres), Limited	8½–9½	..	4 4 3
100,000	Stck.	30 Dec.	5	Do. 5 p. c. Deb. Stk	95–100	..	5 0 0
200,000	5	14 Nov.	6½	Bombay, Limited	7¼–7¾	..	4 3 10
40,000	5	,,	6½	Do. New, £4 paid	5¼–5¾	..	4 10 3
380,000	Stck.	27 Feb.	12	Brentford Consolidated	280–285	..	4 4 3
210,000	,,	,,	9	Do. New	217–222	+2	4 1 0
50,000	,,	,,	5	Do. 5 p. c. Pref.	—	..	—
159,375	,,	16 Dec.	4	Do. 4 p. c. Deb. Stock.	127–132	..	3 0 7
220,000	Stck.	27 Mar.	11	Brighton & Hove Original	232–237	..	4 12 10
208,820	,,	,,	8	Do. A Ord. Stk.	182–187	..	4 5 6
933,500	Stck.	27 Feb.		Bristol, 5 p.c. max.	127–132	..	3 15 9
420,000	20	27 Mar.	11½	British	55–57	+½	3 18 11
50,000	10	12 Mar.	11½	Bromley, Ordinary 10 p. c.	22½–23½	..	4 17 10
71,000	10	,,	8½	Do. 7 p. c.	19–20	..	4 5 0
500,000	10	14 Nov.	5†	Buenos Ayres (New) Limited	9½–10	..	5 0 0
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	102–104	..	5 15 5
150,000	20	27 Feb.	8½	Cagliari, Limited	29–31	..	5 6 5
100,000	10	27 Sept.	8†	Cape Town & District, Ltd.	14–15	+½	5 6 8
50,000	50	2 Nov.	6	Do. 6 p. c. 1st Mort.	58–60	+1	5 0 0
550,000	Stck.	15 Apl.	13½	Commercial Old Stock	330–335*	+4¾	4 0 7
165,000	,,	,,	10½	Do. New do.	255–260*	+3½	4 0 9
165,000	,,	16 Dec.	4½	Do. 4½ p. c. Deb. do.	147–152	..	2 19 2
800,000	Stck.	16 Dec.	13	Continental Union, Limited.	283–287	+4½	4 10 7
200,000	,,	,,	10	Do. 7 p. c. Pref.	217–222	+2	4 10 1
51,620	Stck.	27 Feb.	14	Croydon Com'cial A 10 p. c.	—	..	—
157,500	,,	,,	11	Do. B 7 p. c.	—	..	—
535,000	Stck.	27 Feb.	5½	Crystal Palace Ord. 5 p.c. Stk	130–135	..	3 17 9
60,000	,,	,,	5	Do. 5 p. c. Pref.	—	..	—
486,090	10	30 Jan.	11	European, Limited	26–27	..	4 1 6
354,060	10	,,	11	Do. £7 10s. paid	17½–18½	..	4 9 3
5,746,590	Stck.	13 Feb.	12¾	Gaslight & Coke, A, Ordinary	302–307	+4	4 3 0
100,000	,,	,,	4	Do. B, 4 p. c. max.	108–113	..	3 10 9
665,000	,,	,,	10	Do. C, D, & E, 10 p. c. Pf.	295–300	+5	3 6 8
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	140–145	..	3 9 0
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	205–210	..	3 11 5
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	200–205	..	3 8 3
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	290–295	+3	3 7 10
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	168–172	..	3 9 8
1,061,150	,,	16 Dec.	4	Do. 4 p. c. Deb. Stk.	138–142	..	2 16 4
234,850	,,	,,	4½	Do. 4½ p. c. do.	148–153	..	2 18 9
908,000	,,	,,	6	Do. 6 p. c. do.	204–209	..	2 17 5
70,000	10	30 Oct.	6	Hongkong & China, Limited	13–14	..	4 5 8
3,800,000	Stck.	14 Nov.	12	Imperial Continental	253–258	+3½	4 13 0
376,400	100	1 Feb.	4	Do. 4 p. c. Debs. Red.	100–103	..	3 17 8
473,600	Stck.	13 Feb.	3½	Do. 3½ p. c. Deb. Stk	108–110	..	3 3 8
75,000	5	16 Dec.	6	Malta & Mediterranean, Ltd.	6–6½	..	4 12 4
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p. c. Deb.	113–116	..	4 6 2
250,000	100	,,	4½	Do. 4½ p. c. Debs.	107–109	..	4 2 7
541,920	20	14 Nov.	5	Monte Video, Limited	17–18	..	5 11 1
150,000	5	28 Nov.	8	Oriental, Limited	8¼–8¾	..	4 11 5
135,000	5	,,	8	Do. New, £4 10s. paid	7¼–7¾	..	4 12 10
15,000	5	,,	8	Do. do. 1879, £1 paid	1¾–2	..	4 0 0
60,000	5	12 Mar.	7	Ottoman, Limited	4¾–5¼	..	6 13 4
166,870	10	—	2	Para, Limited	1–1½	..	—
420,000	100	2 Nov.	6	People's Gas } 1st Mtg. Bds.	105–110	..	5 9 1
500,000	100	9 Dec.	6	of Chicago } 2nd Do.	100–105	..	5 14 3
250,000	10	27 Mar.	8	San Paulo, Limited	13½–14½	+½	5 10 4
500,000	Stck.	13 Feb.	15½	South Metropolitan, A Stock	395–405	+10½	3 16 6
1,350,000	,,	,,	12	Do. B do.	315–320	+3	3 15 0
310,000	,,	,,	13	Do. C do.	330–340	+5½	3 16 6
800,000	,,	16 Jan.	5	Do. 5 p. c. Deb. Stk.	175–178	..	2 16 2
60,000	Stck.	12 Mar.	11½	Tottenham & Edmonton, A	250–255	..	4 10 2
60,900	,,	,,	8½	Do. B	—	..	—
170,380	10	30 Dec.	10	Tuscan, Limited	13½–14½	+½	6 18 0
149,900	10	2 Jan.	5	Do. 5 p. c. Debs. Red.	100–102	..	4 18 0

				WATER COMPANIES.			
746,021	Stck.	30 Dec.	10½	Chelsea, Ordinary	325–330	..	3 2 1
150,000	,,	,,	5	Do. 5 p. c. Pref.	170–175	..	2 17 1
160,000	,,	,,	4½	Do. 4½ p. c. Pref. Stk., 1875	—	..	—
175,785	,,	27 Mar.	4½	Do. 4½ p. c. Deb. Stock	155–160	..	2 16 3
1,719,514	Stck.	15 Apl.	7	East London, Ordinary	245–250*	–1½	2 16 0
654,740	,,	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	155–160	..	2 16 3
100,000	,,	,,	3	Do. 3 p. c. Deb. Stk.	105–107	..	2 16 1
700,000	50	16 Dec.	6½	Grand Junction, 10 p.c. max.	125–130	–2	2 10 0
280,000	Stck.	27 Mar.	4	Do. 4 p. c. Deb. Stk.	148–152	..	2 12 8
708,000	Stck.	13 Feb.	12	Kent	335–340	..	3 10 7
160,000	,,	,,	7	Do. New, 7 p. c. max.	207–212	..	3 6 0
1,043,800	100	30 Dec.	7½	Lambeth, 10 p. c. max.	275–280	..	2 11 8
406,200	100	,,	7½	Do. 7½ p. c. max.	227–232	..	3 2 6
330,000	Stck.	27 Mar.	4	Do. 4 p. c. Deb. Stk.	147–152	..	2 12 8
500,000	100	13 Feb.	12¾	New River, New Shares	427–432	+2	2 19 0
1,000,000	Stck.	30 Jan.	4	Do. 4 p. c. Deb. Stk.	153–158	..	2 10 8
902,300	Stck.	16 Dec.	6	S'thwk & V'xhall, Ordinary	168–173	..	3 9 5
126,500	100	,,	6	Do. Do. 7½ p. c. Max.	155–165	..	3 12 9
489,200	Stck.	,,	5	Do. Do. 5 p. c. Pref.	168–173	..	2 17 9
1,019,585	,,	15 Apl.	4	Do. 4 p. c. A Deb. Stk.	147–152*	+2	2 12 8
1,155,066	Stck.	16 Dec.	10	West Middlesex	313–318	+1	3 2 10
200,000	,,	,,	4½	Do. 4½ p. c. Deb. Stk.	155–160	..	2 16 3

*Ex div.

† Next dividend will be at this rate.

Sales of Shares.—The following shares have lately changed hands at public auctions: Twelve original £25 fully-paid shares in the Chelmsford Gas Company (maximum dividend, £10 per cent.), at £39 each; one similar share, £42; and three fully-paid £25 shares (additional capital, with a maximum dividend of £7 per cent.), £29 each.——An important sale of gas stock took place last Thursday at Preston, when Messrs. T. Dewhurst and Son offered £6000 of 5 per cent. preference stock in the Preston Gas Company. It was issued as part of the additional capital of £120,000, and was sold in lots of £100 each; the average price realized being £144 12s. 2d. per lot.——Among other shares in local Companies, Messrs. Stansfield and Co. sold at Bradford last Thursday 24 "A" shares in the Clayton, Allerton, and Thornton Gas Company at £16 each, and 50 shares in the Shelf Water Company (10s. paid) at 12s. apiece.

The Surplus Revenue of the Swansea Gas Company.—At the monthly meeting of the Swansea County Council last Wednesday, the minutes presented by the Electric Lighting Committee stated that they had requested the Town Clerk to report upon the printed accounts of the Gas Company and the right of the Corporation to call upon the Company to apply surplus revenue in reduction of the price charged for gas supplied by them. The confirmation of the minutes having been moved and seconded, Alderman Leeder remarked that the estimate for this year's gas bill which the Streets Committee had to pay was no less than £5273 16s. 9d. He contended it was their duty to reduce such a ridiculous sum as that for the public lighting of the town. He had been blamed in consequence of his opposition to the triple scheme, as being a friend to the Gas Company; but he would stand by the Electric Lighting Committee, as far as he could in any way possible, to reduce that enormous charge to the ratepayers for gas. The amount of the bill was likely to be increased, because the Committee had estimated for 25 extra lamps being put up, at a cost of £2 16s. each per annum. The minutes were adopted.

The Prepayment Meter System at Leeds.—The Leeds Corporation Gas Committee last Friday decided to recommend the Council in future to supply 33 cubic feet of gas for 1d. by automatic meters, instead of 25 cubic feet as at present. This will be equal to 2s. 6d. per 1000 cubic feet, which the Committee believe to be the lowest price they can possibly charge, as there are extra expenses entailed in the collection of payments, the inspection of meters, and clerical work generally, which will make the difference between the charge of 2s. 2d. per 1000 cubic feet to the ordinary consumer, and the 2s. 6d. proposed.

James Milne and Son, Limited.—The annual meeting of this Company was held last Friday at the registered office of the Company, Milton House Works, Edinburgh, when the annual report and balance-sheet for the year ending Dec. 31 last were submitted for the approval of the shareholders. The Directors in their annual report recommended that, after setting aside out of the year's profits a sum of £1250 towards the reserve fund, a dividend should be declared of 6 per cent. on the preference shares, 6 per cent. on the ordinary shares, and 4 per cent. on the deferred shares of the Company; and that the balance of £114 should be carried forward.

Exhibitions of Gas Appliances.—The following exhibitions of gas appliances have to be noted: At Bolton, by Messrs. C. Wilson and Sons, with cookery lectures by Mrs. C. F. Pitcher. At Greenacres and Leeds, by Messrs. Fletcher, Russell, and Co., Limited, with Mrs. Young as lecturer. At Norwich, by Messrs. Fletcher, Russell, and Co., Limited, in conjunction with Messrs. John Wright and Co., Limited, with Mrs. Marshall as demonstrator. At Perth, by Messrs. R. and A. Main, with the assistance of Miss Burden. At Stratford-on-Avon, by Messrs. J. Wright and Co., Limited, Messrs. W. Parkinson and Co., and others; with lectures by Miss Thwaites. At Tunbridge Wells, by Messrs. Richmond and Co., Limited, with lectures by Miss Barker and Mr. Richmond.

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Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS, should be received not later than the FIRST POST on SATURDAY.

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*** See Advertisement p. II., centre of JOURNAL.

Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

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JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c. CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special Attention to Repairs.

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BROTHERTON AND Co., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

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TUBES and Fittings for Gas, Steam, and Water, in stock to 8 inches diameter; Iron and Steel Ascension-Pipes.
JOHN SPENCER, Globe Tube Works, WEDNESBURY; and 14, Great St. Thomas Apostle, LONDON.

HUTCHINSON BROTHERS, Gas Engineers, &c., Falcon Works, Barnsley, Makers of Wet and Dry Gas-Meters, Brass-Work, and general Gas Apparatus, Lead Saturators, Tanks, &c., Tools, and Gas-Works Sundries. (See p. 833, last week's issue.)
Telegrams: "HUTCHINSON BROS., BARNSLEY."

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for, Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and adroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
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TO GAS COMPANIES MAKING SULPHATE OF AMMONIA.

THE Use and Value of Sulphate of Am- monia as Manure—A Leaflet, suitable for Distribution among the Farmers of their respective Districts, by WILLIAM ARNOLD, F.S.I., Land Agent, Rating Surveyor, and Valuer (late Chairman of the Tamworth Gaslight and Coke Company); together with valuable Formulæ, Rotation of Crops and Manures for the same, intended for the use of Tenant Farmers and others interested in Land, and to promote the sale of Sulphate of Ammonia for the production of Corn and other Crops by English Gas Companies.
Prices: 100 Copies, 10s.; 250 Copies, £1 2s. 6d.; 500 Copies, £2; 1000 Copies, £3 15s.
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WANTED, by a thoroughly competent Man, a Situation as WORKING FOREMAN or MANAGER. Good Retort Setter and Carbonizer. Town or Country. Excellent References.
Address W. H. C., 68, Marlborough Street, EAST GREENWICH.

WANTED, a re-engagement as Foreman of small Gas-Works, or as Foreman Gas and Water Works Fitter. Good Carbonizer. Excellent Testimonials.
Reference may be made to G. H. DUNCAN, Manager, Gas-Works, New Tredegar, *vid* CARDIFF.

TO GAS COMPANIES AND MANAGERS.

A GAS Manager's Son is desirous of obtaining a SITUATION in any capacity on a small Gas-Works. Is willing to make himself generally useful.
Can be well recommended.
Apply ENGINEER, Gas Company, Littlehampton, SUSSEX.

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SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
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WANTED, a Situation as Gas Stoker, to take charge of small Gas-Works. Married. Age 26. Six Years' References.
Address A. G. H., 12, Elm Grove Terrace, Twerton, BATH.

WANTED, by a Firm of Gas Engineers in the North of England, two DRAUGHTSMEN.
Apply, by letter, to No. 2653, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Fitter for Gas and Water Works. Able to lay Mains, fix Services, Meters, &c., and be generally useful.
Apply, stating Wages, &c., to G. H. DUNCAN, Manager and Secretary, Gas and Water Works, New Tredegar, *vid* CARDIFF.

GAS Stoker Wanted (Married preferred), used to Shovel Charging and Engine and Exhauster. Permanent Situation to steady, reliable Man.
Wages and other Information can be obtained from the MANAGER, Gas-Works, RICKMANSWORTH.

WELLINGBOROUGH GASLIGHT COMPANY, LIMITED.

WANTED, a competent Man as Meter INSPECTOR and STOREKEEPER.
Apply, by letter, stating Qualifications and Experience and Wages required, to S. H. KIMBELL, Secretary.

THE Directors of the Sunbury Gas Company require a practical WORKING MANAGER to take charge of the Works at Sunbury.
Salary to commence at £100, with good House and Garden, Gas, and Firing.
Applications, accompanied by not more than Three Testimonials, to be sent to C. E. GODDARD, Secretary to the Company, SUNBURY-ON-THAMES, by the 28th inst.

A YORKSHIRE Colliery, having a large output of first-class Gas Coal, is open to appoint a REPRESENTATIVE for GAS COAL CONTRACTS exclusively. This is a good opening for a Man with a practical knowledge of Gas Making, and a connection among Gas-Works.
State, in strict confidence, past and present Engagements, when at liberty, Age, Salary, and Particulars of Business Connections, to No. 2652, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, / NEWTON GRANGE, NEWBATTLE, DALKEITH, } SCOTLAND.

TO EMPLOYERS, COMPANY DIRECTORS, ETC.

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PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
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INCREASE the Efficiency of your PURIFIERS by adopting CRIPPS'S PATENT BYE-PASS VALVE in the lower Tiers of Sieves. Practical Experience proves their Economy. Engineers are repeating orders after thorough trial.
References and Particulars can be obtained from the Makers—
C. & W. WALKER, Midland Iron-Works, Donnington, near Newport, SALOP.
And J. EVERY & SON, Phœnix Iron-Works, LEWES.

WANTED, a Purifier, about 8 ft. by 6 ft. by 3 ft.; two 6-inch FOUR-WAY VALVES and STATION GOVERNOR (6-inch).
GAS-WORKS, Stevenston, AYRSHIRE.

WANTED, four second-hand Purifiers, 16 feet square, with Centre-Valve for 12-inch Connections, and Lifting Apparatus.
Address No. 2654, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a good second-hand Gas- HOLDER, about 35 to 40 feet diameter, and 16 or 18 feet deep, with Steel, Wrought-Iron, or Cast-Iron Tank.
Apply, stating lowest Price, to No. 2651, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS Purifiers (Two) for Sale, 6 ft. by 6 ft., with Grids and Lifting Apparatus complete.
W. T. MERCER, Secretary, Gas Company, Tenterden, KENT.

FOR SALE—One Station Meter, 6000 cubic feet capacity, by J. & J. Braddock, Oldham, in first-class condition; also one good 10,000 cubic feet STATION METER, by Parkinson, London.
Apply Box 19, Post Office, ACCRINGTON.

FOR SALE—100-Light and 30-Light GASOLENE PLANTS (in use at present time, and in perfect working order), which we are replacing with Electric Light.
For further Particulars, apply to DRAKE AND GORHAM, Electrical Engineers, 66, Victoria Street, Westminster, LONDON, S.W.

FOR SALE—18 4-inch H and Dip Pipes, one 6-inch STATION GOVERNOR, and several BUCKSTAVES.
Particulars to be had from the undersigned.
JOHN M'COLL, Manager.
Gas-Works, Halesowen.

Now Ready, Handsome Cloth, 9s. Post free,

GAS MANUFACTURE
(THE CHEMISTRY OF);

A HANDBOOK ON THE PRODUCTION, PURIFICATION, AND TESTING OF ILLUMINATING GAS, AND THE ASSAY OF THE BYE-PRODUCTS OF GAS MANUFACTURE.

For the Use of Students.

By W. J. ATKINSON BUTTERFIELD, M.A., F.C.S.,

Head Chemist, Gas-Works, Beckton, London, E.

WITH NUMEROUS ILLUSTRATIONS.

*** This work deals with the MOST MODERN DEVELOPMENTS of the subject; and the chapter treating of the BYE-PRODUCTS will be found of special interest.

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Sulphate of Ammonia Plant

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Is the newest in the Market, and is the outcome of practical experience in Sulphate Making.

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GAS AND CHEMICAL ENGINEERS,
MIDDLESBROUGH-ON-TEES.

URBAN DISTRICT COUNCIL OF BUXTON.

CONTRACT FOR TAR AND LIQUOR.

THE Urban District Council invite TENDERS for the purchase of the TAR and AMMONIACAL LIQUOR produced at their Works in Ashwood Dale, during One or more Years.

Particulars to be obtained of Mr. Geo. Smedley, Gas Department, Town Hall, Buxton.

The Council do not guarantee to accept the highest or any tender.

Tenders, endorsed "Tender for Tar, &c.," to be addressed to the Chairman of the Gas Committee, and sent in not later than the 1st of June.

By order,
JOSIAH TAYLOR,
Clerk to the Council.

Buxton, April 10, 1896.

TENDERS FOR COAL.

THE Urban District Council of Buxton invite TENDERS for the supply of about 1500 Tons of COAL per annum for One or more Years, to be delivered at their Siding on the Midland Railway in Ashwood Dale, Buxton.

Tenders, endorsed "Gas Coal," addressed to the Chairman of the Gas Committee, to be delivered at the Town Hall, not later than Noon on the 2nd of May.

Forms of Tender and Particulars may be obtained of Mr. Geo. Smedley, Engineer, Gas Office, Town Hall, Buxton.

The Council do not bind themselves to accept the lowest or any tender.

By order,
JOSIAH TAYLOR,
Clerk.

Buxton, April 10, 1896.

ULVERSTON URBAN DISTRICT COUNCIL.

TO TAR DISTILLERS.

THE Gas and Water Committee invite TENDERS for the purchase of the surplus TAR produced at their Works during the Year commencing the 1st of July next.

Further Particulars and Forms of Tender may be had on application to the undersigned.

Sealed tenders to be sent not later than the 30th inst., addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Tar."

The Committee do not bind themselves to accept the highest or any tender.

JNO. SWAN,
Engineer and Manager.

ULVERSTON URBAN DISTRICT COUNCIL.

TENDERS FOR COAL AND CANNEL.

THE Gas and Water Committee invite TENDERS for the supply of best screened GAS COAL, NUTS, and CANNEL, for One, Two, or Three Years, commencing the 1st of July next.

Parties tendering must give full Particulars of the Coal and Cannel they propose to supply; and name the Pit from which the same will be raised.

Further Information and Forms of Tender may be obtained on application to the undersigned.

Sealed tenders to be sent in not later than the 30th inst., addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Coal or Cannel."

The Committee do not bind themselves to accept the lowest or any tender.

JNO. SWAN,
Engineer and Manager.

COUNTY BOROUGH OF HALIFAX.

THE Gas-Works Committee of the Halifax Corporation are prepared to receive TENDERS for the supply of 60,000 Tons of GAS COAL and 10,000 Tons of CANNEL COAL, to be supplied in such quantities as may from time to time be determined by the Gas-Works Committee during the Year ending the 30th of June, 1897.

Forms of Tender and further Information may be obtained on application to Mr. Thomas Holgate, Manager, Gas-Works, Halifax.

Tenders, endorsed "Tender for Coal," must be sent to me before Ten a.m., on the 30th of April, 1896.

The Committee do not bind themselves to accept the lowest or any tender.

By order,
KEIGHLEY WALTON,
Town Clerk.

LIVERPOOL UNITED GASLIGHT COMPANY.

THE Directors of the Liverpool United Gaslight Company are prepared to receive TENDERS for the supply of 83,000 Tons of CANNEL and 75,000 Tons of COAL, to be delivered at the various Works of the Company, during the period of Twelve Months between the 1st of July, 1896, and the 30th of June, 1897.

Tenders will be received for the whole or any portion of the above quantity.

The Directors reserve the right to accept tenders for the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any tender.

Full Particulars and printed Forms of Tender can be obtained, on application to the undersigned, at the Gas Office, Duke Street, Liverpool, to whom Tenders (on the printed form only) must be delivered at or before Ten a.m., on Monday, the 4th of May, endorsed "Tender for Cannel and Coal."

By order,
WILLIAM KING,
Engineer.

Gas Office, Duke Street, Liverpool,
April 9, 1896.

BOROUGH OF COLNE.

TO SULPHURIC ACID MAKERS.

THE Gas Committee of the Corporation of Colne invite TENDERS for the supply of SULPHURIC ACID for One Year.

Estimated quantity required, about 120 Tons.

Further Particulars can be obtained from the Engineer, to whom sealed tenders must be delivered on or before Monday, the 27th day of April, 1896, endorsed "Tender for Acid."

The Committee do not bind themselves to accept the lowest or any tender.

H. SIMMONDS, C.E.,
Engineer and Manager.

Gas-Works Offices, Colne,
April 17, 1896.

BOROUGH OF COLNE.

THE Gas Committee of the Colne Corporation invite TENDERS for the purchase of the surplus TAR made at their Works, for the Year ending March 31, 1897.

Further Particulars can be obtained on application to the Engineer, to whom sealed tenders must be delivered on or before Monday, the 27th day of April, 1896, endorsed "Tender for Tar."

The Committee do not bind themselves to accept the highest or any tender.

H. SIMMONDS, C.E.,
Engineer and Manager.

Gas-Works Offices, Colne,
April 17, 1896.

TENDERS FOR GAS COAL.

THE Brentwood Gas and Coke Company invite TENDERS for the supply of about 4000 Tons of screened GAS COAL in Trucks at Brentwood Railway Station (G.E.R.), at per ton, to be delivered in the following quantities the second week of each month: June, 140 Tons; July, 160 Tons; August, 200 Tons; September, 400 Tons; October, 450 Tons; November, 500 Tons; December, 560 Tons; January, 500 Tons; February, 350 Tons; March, 300 Tons; April, 250 Tons; May, 190 Tons.

Tenders (with Analysis of the Coal to be supplied), and Terms for monthly payments, to be sent to the undersigned, on or before May 2.

The Directors do not bind themselves to accept the lowest or any tender.

C. A. FIELDER,
Secretary.

Brentwood, Essex,
April 17, 1896.

IRONBRIDGE (SALOP) GASLIGHT COMPANY, LIMITED.

THE Directors of the above Company invite TENDERS for the necessary EXCAVATIONS, FOUNDATIONS, &c., for, and the provision and erection of, a SINGLE-LIFT GASHOLDER, having a capacity of about 62,000 cubic feet, together with a STEEL TANK and all requisites complete for the Gasholder.

The Specification and Drawings may be seen on application to Mr. W. Belton at the Gas-Works, Shrewsbury; and the Site may be inspected on application at the Gas Offices, Ironbridge, Shropshire.

Tenders must be addressed to the Secretary, Mr. Alfred H. Thorn, Solicitor, Ironbridge, endorsed "Tender for Gasholder," and must be delivered not later than May 6, 1896.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
ALFRED H. THORN,
Secretary.

Gas Offices, Ironbridge, Shropshire,
April 18, 1896.

TENDERS FOR GAS COAL.

THE Directors of the Sunderland Gas Company are prepared to receive TENDERS for GAS COAL for One, Two, or Three Years (in lots of 5000 Tons per annum and upwards), to be delivered by Rail on the Company's Sidings at Hendon, or Ayre's Quay Gas-Works, in such monthly proportions, during the continuance of the Contract, as the make of Gas may render necessary.

The Coal to be clean, dry, and fresh worked.

Tenders, endorsed "Tender for Gas Coal," specifying the description of Coal, the Name of the Pit, and the particular Seam from which the Coal is to be supplied, to be left at the Offices of the Company, Borough Road, Sunderland, on or before Ten a.m. on Tuesday, April 28.

Short Weight or Inferior Quality to be allowed for.

The Company do not bind themselves to accept the lowest or other tender until after a satisfactory trial of the Coal to which such Tender may relate shall have been made.

J. H. COX,
Secretary.

Sunderland, April, 1896.

TUNBRIDGE WELLS GAS COMPANY.

TO COAL FACTORS AND OTHERS.

THE Directors of the Tunbridge Wells Gas Company will be prepared on Tuesday, the 12th day of May next, to receive TENDERS for the supply of 18,000 Tons of either NEW PELTON, NEW TANFIELD, PELAW MAIN, EAST PONTOP, SOUTH HETTON, LONDONDERRY, NORTH PELAW, or other approved GAS COALS at the option of the Directors, to be delivered free into the Gas Company's Siding on the South-Eastern Railway at Tunbridge Wells, in accordance with Terms and Conditions, which may be obtained on application.

The tenders are to be sent to me by not later than Six o'clock p.m. on Tuesday, the 12th day of May, marked "Tender for Coals."

The lowest or any tender will not necessarily be accepted.

By order,
JOHN READ,
Secretary and General Manager.

Gas Company's Office,
Tunbridge Wells.

THE Town Council invite Tenders for the supply at Peterborough during the ensuing Five Months, of about 15,000 Gallons of GAS TAR.

Particulars and Tender Forms may be obtained at my Office.

Tenders, endorsed "Tar," to be sent to the Town Clerk, W. Mellows, Esq., on or before the 30th inst.

The Town Council do not pledge themselves to accept the lowest or any tender.

J. W. WALSHAW,
Borough Surveyor.

Guildhall, Peterborough,
April 18, 1896.

BOROUGH OF BEVERLEY.

TO TAR DISTILLERS AND OTHERS.

THE Corporation of Beverley desire to receive TENDERS for the purchase of the surplus TAR produced at the Gas-Works for One Year from the 1st day of May next.

Particulars may be obtained on application to Mr. Gibson, the Manager at the Works, Beverley; and tenders, marked "Tar," must be delivered at my Office not later than Ten a.m. on Tuesday, the 28th inst.

The Corporation do not bind themselves to accept the highest or any tender.

By order,
J. WILLIS MILLS,
Town Clerk.

April 11, 1896.

SOUTH SHIELDS GAS COMPANY.

TO COALOWNERS.

THE Directors of the South Shields Gas Company invite TENDERS for the supply of 40,000 Tons of clean, unscreened GAS COAL, for delivery, into Craft, and at the Company's Depôt, South Shields, as required, over a period of Twelve Months.

The Directors reserve to themselves the right of taking the Coal in one or more lots.

The lowest or any tender not necessarily accepted.

Particulars as to Deliveries, &c., may be obtained at the Gas-Works, on application to Mr. W. J. Warner, the Engineer.

Sealed tenders to be delivered to the undersigned, not later than Friday morning, the 24th inst., endorsed "Tender for Coal."

J. H. PENNEY,
Secretary.

Gas Offices, Chapter Row, South Shields,
April 10, 1896.

SHEFFIELD UNITED GASLIGHT COMPANY.

TO IRON ROOF AND GIRDER CONTRACTORS.

THE Directors of this Company invite TENDERS for the supply and erection of IRON ROOF, together with Girder and Column to carry the same, for Boiler-House at their Grimesthorpe Station.

The Roof is 54 feet long by 65 feet wide.

Drawings may be seen, and Specification with Bill of Quantities and Form of Tender obtained, on application to the Engineer, Mr. Fletcher W. Stevenson, on payment of 10s. 6d., which will be returned on receipt of *bonâ-fide* tender.

Sealed tenders, endorsed "Tender for Iron Roof," must be delivered by post to the undersigned, at the Company's Offices, not later than first post on Monday, the 4th day of May.

The Directors do not bind themselves to accept the lowest or any tender.

HANBURY THOMAS,
General Manager.

Commercial Street, Sheffield,
April 16, 1896.

SHEFFIELD UNITED GASLIGHT COMPANY.

TO MAKERS OF DEEP WELL PUMPS.

THE Directors of this Company invite TENDERS for the supply and erection of a pair of DEEP WELL PUMPS, to lift 10,000 Gallons of Water per Hour from a depth of about 65 feet below ground level, and force to a height of 70 feet above ground level.

Further Particulars and Plan of the Site of Well may be obtained on application to the Engineer, Mr. Fletcher W. Stevenson, and upon payment of 10s. 6d., which will be returned on receipt of *bonâ-fide* tender.

Sealed tenders, endorsed "Tender for Pumps," must be delivered by post to the undersigned, at the Company's Offices, not later than first post on Monday, the 4th day of May.

The Directors do not bind themselves to accept the lowest or any tender.

HANBURY THOMAS,
General Manager.

Commercial Street, Sheffield,
April 17, 1896.

NEWMARKET GAS COMPANY.

ISSUE OF £5000 THREE AND A QUARTER PER CENT. PERPETUAL DEBENTURE STOCK.

SALE BY TENDER.

MINIMUM PRICE, £100 PER £100 STOCK.

THE Directors invite Tenders for £5000 PERPETUAL DEBENTURE STOCK authorized to be raised under the Newmarket Gas Company's Act, 1895, which will bear a fixed and Perpetual Preferential Rate of Interest of Three Pounds and Five Shillings per cent. per annum, payable Half Yearly (subject to Income-Tax).

Allotments to the highest bidders.

Tenders must be delivered on or before Saturday, the 2nd of May, 1896.

Forms of Tender, with Particulars and Conditions, may be obtained on application from the Secretary, at the Company's Office, Exning Road, Newmarket, or from the Company's Bankers, Messrs. Hammond and Co., at the Newmarket Bank, or from Messrs. Button and Aylmer, Solicitors, Newmarket.

By order of the Directors,
J. H. TROUGHTON,
Secretary and Manager.

Gas Office, Newmarket,
April 1, 1896.

BOROUGH OF WARRINGTON.
(GAS DEPARTMENT.)

THE Gas Committee are prepared to receive TENDERS for the supply of RETORTS and FIRE-CLAY MATERIAL.

Full Particulars can be obtained on application to the Engineer, Mr. W. S. Haddock.

Sealed tenders, endorsed, must be sent in by Ten a.m., the 8th prox.

FREDK. TAYLOR,
Secretary.

Gas Offices, Warrington,
April 11, 1896.

CORPORATION OF MOSSLEY.
(GAS DEPARTMENT.)

TENDERS are invited for the Tar produced for Sale at the Works during the Twelve Months ending the 25th of March, 1897; also for SPENT OXIDE, and the supply of NEW OXIDE required.

Particulars and Forms of Tender from the Manager, Mr. R. Merrell.

Sealed tenders to be sent to me not later than the 26th inst.

The Committee do not bind themselves to accept the highest or any tender.

JOSEPH HYDE,
Town Clerk.

TENDERS FOR TAR.

THE Derby Gaslight and Coke Company are prepared to receive TENDERS for the purchase of the surplus TAR they will have for disposal during the Twelve Months ending March 31, 1897.

Further Particulars on application to the undersigned.

Tenders must be addressed to the Chairman of the Finance Committee of the Derby Gaslight and Coke Company, Friar Gate, Derby, endorsed "Tender for Tar," and delivered on or before April 30 next.

By order,
RICHARD FISHER, Secretary.

Gas Office, Derby,
April 15, 1896.

COUNTY BOROUGH OF BURNLEY.

TO TAR DISTILLERS.

THE Gas Committee of the Corporation of Burnley are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Gas-Works during the period of Twelve Months ending March 31, 1897.

The Tar will be delivered by the Corporation into Boats provided by the Purchaser at the Gas-Works Wharf on the Leeds and Liverpool Canal.

Tenders, under seal, endorsed "Tender for Tar," and addressed to the Chairman of the Gas Committee, Town Clerk's Office, Town Hall, Burnley, to be delivered not later than Wednesday, the 29th of April, 1896.

JOHN P. LEATHER,
Gas Engineer.

Gas-Works, Burnley,
April 8, 1896.

WHITTINGTON GAS COMPANY, LIMITED.

GASHOLDER TANK.

THE Directors of the above Company are prepared to receive TENDERS for a BRICK and PUDDLE TANK, 61 ft. 6 in. in diameter and 20 feet deep, to be constructed at their Works at Whittington, near Chesterfield, Derbyshire.

Drawings and Specification may be seen at the London Offices of the Company, 85, Gresham Street, Guildhall, E.C., on application to the Secretary.

Tenders, to be addressed to the Secretary as above, and marked "Tender for Tank," must be sent in not later than Thursday morning, the 7th of May.

The Directors do not bind themselves to accept the lowest or any tender.

(Signed) A. H. CÆSAR, Secretary.

GEORGETOWN (BRITISH GUIANA) GAS COMPANY, LIMITED.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Shareholders of the above Company will be held at the Offices of the Company, 30, Gracechurch Street, in the City of London, on Tuesday, the 12th day of May next, at Three o'clock in the afternoon precisely, to receive the Directors' Report and the Accounts of the Company for the Half Year ended the 31st day of December last, to declare a Dividend, to elect Directors and an Auditor in place of those retiring by rotation, and to transact the General Business of the Company.

The TRANSFER BOOKS WILL BE CLOSED from the 29th inst. to the 12th prox., both inclusive.

By order of the Board,
SAMUEL WOOD,
Secretary.

Offices: 30, Gracechurch Street, London,
April 14, 1896.

By Order of the Directors.

TO TRUSTEES, INVESTORS, AND OTHERS.

NOTICE OF SALE BY AUCTION BY

MESSRS. CRAWTER, at the Cock Inn, Waltham Abbey, on Tuesday, April 21, 1896, at Five o'clock, of 125 SHARES of £10 each, known as "C" Shares, in the WALTHAM ABBEY AND CHESHUNT GAS AND COKE COMPANY, which, at the present Price of the Gas sold by the Company, are entitled to a Dividend, when earned, of 10½ per cent.

The Shares rank for Dividend equally with the existing £5000 Additional Capital authorized by the Company's Act, 1869, known as "B" Shares, on which a Dividend of 5 per cent. per annum has for many years past and up to the present been paid; thus offering an Investment which must increase in value.

Particulars and Conditions of Sale may be obtained at the OFFICES of the Company, Waltham Abbey, ESSEX; at the PLACE OF SALE; of MR. J. CRAWTER, 41, BEDFORD ROW, W.C.; and of MESSRS. CRAWTER, Land Agents and Auctioneers, Cheshunt, HERTS.

ISSUE OF STOCKS AND SHARES BY AUCTION UNDER PARLIAMENTARY POWERS.

MR. ALFRED RICHARDS undertakes the issuing by Auction of GAS AND WATER SHARES under Parliamentary Powers.

He also holds MONTHLY SALES of GAS AND WATER SHARES at the Auction Mart, Tokenhouse Yard, E.C.

Terms for the issuing of Capital, and also for offering to auction Gas and Water Shares, and all Particulars relating thereto, may be had of Mr. Alfred Richards.

Offices: 18, FINSBURY CIRCUS, E.C.

HARROW AND STANMORE GAS COMPANY.

SALE OF SHARES BY ORDER OF THE DIRECTORS.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, London, E.C., on Monday, April 27, at Two o'clock, in lots of Ten Shares each,

500 £10 "C" SHARES (fully paid)
IN THE
HARROW AND STANMORE GAS COMPANY,

ranking for a Standard Dividend of 7 per cent.; the last Dividend on the same class of Shares having been at the rate of 5½ per cent. per annum, and offering an Investment of the soundest character.

Particulars of the SECRETARY of the Company at the Gas-Works, HARROW; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

HUNTER'S

OXIDE OF IRON.

JAMES HUNTER, MINER, AND SHIPPER OF
NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.

Samples and Prices on application.

5, PRINCES STREET, PORT GLASGOW.

Telegrams: "HUNTER, PORT GLASGOW."

Established 1872.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD
BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED.

WARNING.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED.

WHEREAS, it has been brought to the notice of the INCANDESCENT GAS-LIGHT COMPANY, LIMITED, THAT DIVERS FIRMS UPON THE CONTINENT OF EUROPE are Manufacturing Incandescent Gas-Mantles, and are sending the same into this Country, and are advertising for Agents to push the sale of these Mantles,

THIS IS TO GIVE NOTICE, THAT ALL SUCH MANTLES ARE INFRINGEMENTS OF THE COMPANY'S PATENT, and that the Company will take proceedings for Infringement against all persons purchasing or using any of such Incandescent Gas-Mantles. THE COMPANY OWN THE MASTER PATENTS in this Country for the manufacture of Incandescent Gas-Mantles, and the validity of such Patents has already been certified by the Honourable Mr. Justice Romer, and the Company will enforce their Patent Rights against all Infringers.

FAITHFULL & OWEN,
Solicitors for the Incandescent Gas-Light Company, Limited.
11, Victoria Street, Westminster.

NOTICE.

Whereas it has come to the knowledge of the INCANDESCENT GAS-LIGHT COMPANY, Limited, of Palmer Street, Westminster, that a Company called the Meteor Incandescent Gas-Light Company, Limited, a firm known as Putz and Co., and a Company known as the Evening Sunlight Incandescent Light Company or the New Incandescent Light Company, are selling, and are offering for sale, forms of Incandescent Gas-Lights called respectively the "Meteor," the "Champion," and the "Evening Sunlight,"

THIS IS TO GIVE NOTICE, THAT THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED, will commence ACTIONS FOR INFRINGEMENTS OF THEIR PATENTS against all persons found dealing in any manner with the said "Meteor," "Champion," or "Evening Sunlight" Incandescent Gas-Lights, which are all constructed in Infringement of the Patent of the Incandescent Gas-Light Company, Limited.

The validity of the Company's Patent has been certified by the Hon. Mr. Justice Romer.

FAITHFULL & OWEN,
11, Victoria Street, S.W.
Solicitors for the Incandescent Gas-Light Company, Limited.

NOTICE.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED, Hereby Give Notice, that they only supply their Mantles subject to the following express Conditions, which are printed and pasted on each box:—

> "The Incandescent Gas-Light Company, Limited, in supplying the Mantle contained in this box, grant a Limited License to the purchaser to sell or use the same on the express condition that neither the purchaser nor any other person into whose hands the same may come shall use or sell the said Mantle except in connection, or for use, with Burners sold or supplied by the Company; any other sale or use will amount to Infringement of the Company's Patents. The Company supply Mantles for the purpose of renewals at the nominal price of 1s. 3d., subject to the Conditions and Limitations above set forth."

In the case of *The Incandescent Gas-Light Company, Limited v. Cantelo*, **Mr. Justice Wills upheld the Validity of these Conditions and Limited License; and, in the course of his Judgment, said:—**

> The patentee has the sole right of using and selling the articles; and he may prevent anybody from dealing with them at all. Inasmuch as he has the right to prevent people from using them or dealing in them at all, he has the right to do the lesser thing—that is to say, to impose his own conditions. It does not matter how unreasonable or how absurd the conditions are. It does not matter what they are if he says at the time when the purchaser proposes to buy, or the person proposes to take a license: 'Mind I only give you this license on this condition;' and the purchaser is free to leave it or take it as he likes. If he takes it he must be bound by the condition."

In the case of *The Incandescent Gas-Light Company v. Hirschfeld and Others*, **the Honourable Mr. Justice Romer certified that the Validity of the Plaintiffs' Patents was established. Infringers in future will be liable to costs as between Solicitor and Client.**

(Signed) **FAITHFULL & OWEN,**
Solicitors for the Incandescent Gas-Light Company, Limited.

HOLMSIDE GAS COALS.

PRESENT DAILY PRODUCE OVER 4000 TONS.

LATEST ANALYSIS—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation.

Yield of Gas Per Ton . . 11,205 Cubic Feet.
Illuminating Power, $16\frac{1}{10}$ Stand. Sperm. Candl.
Coke (of good & pure quality) $13\frac{3}{4}$ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.

RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton . . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . $13\frac{1}{2}$ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash. . . . . 1·34 Per Cent.
Tar. . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor $94\frac{1}{2}$ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COAL-FIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

COKE-BREAKERS,

PRICES REDUCED.

(THOMAS & SOMERVILLE'S PATENT)

New Design, with two Cutting Rollers, making less Breeze than their old pattern.

GEORGE WALLER & CO.,
165, QUEEN VICTORIA STREET, E.C.
And at STROUD, GLOUCESTERSHIRE.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.
LONDON OFFICE:
90, CANNON STREET, E.C.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Danish Gas Company, Bombay Gas Company, San Paulo Gas Company, Alliance and Dublin Consumers' Gas Company, Ipswich Gaslight Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For Prices, &c., apply to the

HARTON COAL COMPANY,

LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON,
FITTER.

NOTE THIS NOTICE PLEASE.

OUR
LONDON OFFICE FOR VISITORS
TO THE METROPOLIS IS STILL
3 & 4, Lime Street Square, E.C.;
BUT
ALL COMMUNICATIONS
MUST NOW BE
ADDRESSED—
LITTLE & GRAHAM, Ld.,
TRANSPORT APPLIANCE WORKS,
SMETHWICK,
BIRMINGHAM.

JUNKERS' CALORIMETER

SHOWS AT A GLANCE THE HEATING VALUE OF GAS.

NO BOMB. NO ANALYSIS.

See Illustrated Advertisement in the "JOURNAL" for April 14, (p. 786).

Reduced Price £15 15s.

HERMANN KÜHNE,
25-35, New Broad Street, London, E.C.

LOW MOOR BLACK BED GAS COAL.

YIELD OF GAS PER TON - 10,375 CUBIC FEET.
ILLUMINATING POWER - 17·50 SPERM CANDLES.
COKE . . . . . 75 PER CENT.

Prices, f.o.r. or f.o.b., on application to

GEORGE & JOHN HAIGH,
RAVENS LODGE AND CONYERS' COLLIERIES,
DEWSBURY.

A TRIAL IS RESPECTFULLY SOLICITED.

LONDONDERRY GAS COALS

FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.
Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887,
for
CANNEL & COAL.

TYNE
BOGHEAD CANNEL.

Yield of Gas per ton . . . . . 13,155 cub. ft.
Illuminating Power . . . . . 38·22 candles.
Coke per ton . . . . . 1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 17·8 candles.
Coke . . . . . 70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
12, JOHN STREET, ADELPHI, LONDON, W.C.

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

LONDON OFFICE: R. CULL, 84, OLD BROAD ST., E.C.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.,
B Lombard Street,
NEWCASTLE-ON-TYNE.

W. RICHARDSON, Fitter.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL Co., Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by

Messrs. J. & H. S. PATTINSON, *May 28, 1895.*

Yield of Gas per Ton . .	10,500 Cub. Ft.
Illuminating Power . .	16·9 Candles.
Coke (of good quality) . .	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

ESTABLISHED 1862.

TRADE MARK.

NEW GAS PLANT CEMENT

For all Joints in connection with

SULPHATE PLANT. OIL-GAS PLANT. GAS. TAR. AMMONIA.

SAMPLES ON APPLICATION.

SPECIAL PAINTS FOR GAS-WORKS.

Telegrams "Enamel." Nat. Tel. 1759.

John E. Williams & Co., *Victoria Paint Works* **Manchester.**

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

W. E. SANDER,

COMMISSION AGENT, BERLIN, 41, FRIEDRICH STR.

SPECIALITIES: Incandescent Lamp Burners and Mantles (with or without electric lighting from any distance, by button from the wall, etc.).

INCANDESCENT SPIRIT LAMPS.

Electro-technical Ware of all kinds.

IMPORT and EXPORT.

STOURBRIDGE

RETORTS AND FIRE-BRICKS.

BEST QUALITY.

KING BROTHERS, STOURBRIDGE.

[See Illustrated Advertisement, April 7, p. 780.]

OXIDE OF IRON.

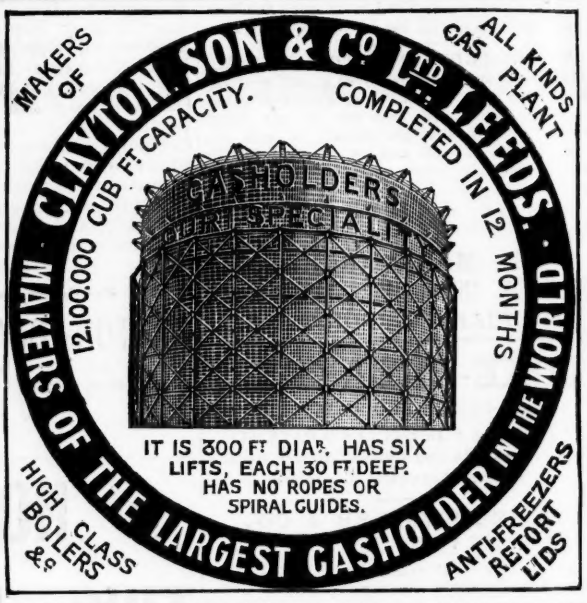
NATURAL BOG ORE FROM OWN MINES.

Samples and Prices on application.

Wm. H. MÜLLER & CO.,

81, PALMERSTON BUILDINGS, LONDON, E.C.

TRADE MARK: "Compascum." Telegraphic Address: "FERRUM."


MAKERS OF
CLAYTON, SON & Co LTD LEEDS
ALL KINDS GAS PLANT
12,100,000 CUB FT CAPACITY.
COMPLETED IN 12 MONTHS
GASHOLDERS
OUR SPECIALITY
IT IS 300 FT DIAR. HAS SIX LIFTS, EACH 30 FT DEEP. HAS NO ROPES OR SPIRAL GUIDES.
MAKERS OF THE LARGEST GASHOLDER IN THE WORLD
HIGH CLASS BOILERS &c
ANTI-FREEZERS RETORT LIDS

GIRDERS, ROOFS, & ALL KINDS OF STRUCTURAL IRONWORK.

London Office: 60, QUEEN VICTORIA STREET, E.C.

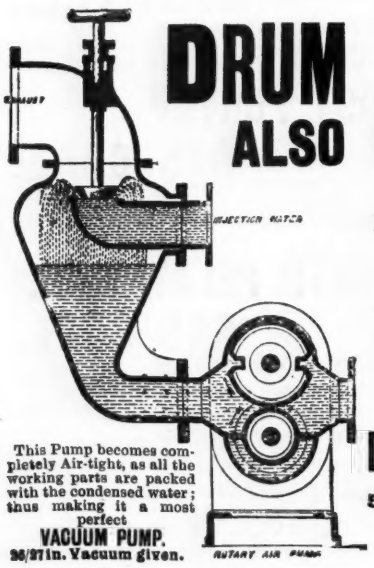
Telegraphic Addresses: "GAS, LEEDS," "ECLARAGE, LONDON."

"The Force of the Piston Pump with the Capacity of the Centrifugal combined."

JOHNSON'S PATENT

DRUM PUMP AND EXHAUSTER

ALSO VACUUM PUMP AND CONDENSER.



This Pump becomes completely Air-tight, as all the working parts are packed with the condensed water; thus making it a most perfect

VACUUM PUMP.

26/27 in. Vacuum given.

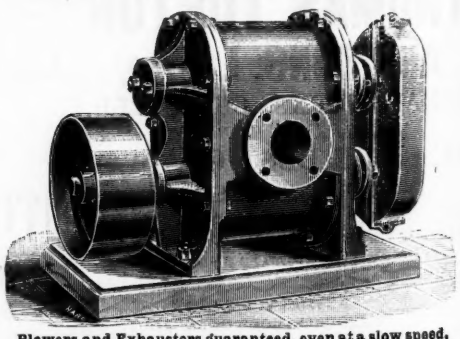
No Priming, Valves, or Frictional Working Parts.

The Pump of the future for quickly and economically moving large Bodies of Water, Semi-fluid, &c.

DRUM ENGINEERING Co.

55, ATHOL ROAD,

BRADFORD.



Blowers and Exhausters guaranteed, even at a slow speed, to give a working pressure of 3 lbs. and upwards, and this without losing power by creating frictional Heat.

HEATHCOTE GAS COAL.

RICH IN ILLUMINATING POWER AND YIELD OF GAS.

ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.

MAINTAINS A HIGH STANDARD IN RESIDUALS.

THE GRASSMOOR Co., Ld., CHESTERFIELD.

JOHN BROWN & CO., Ltd., Sheffield,

Proprietors of

ALDWARKE MAIN, CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

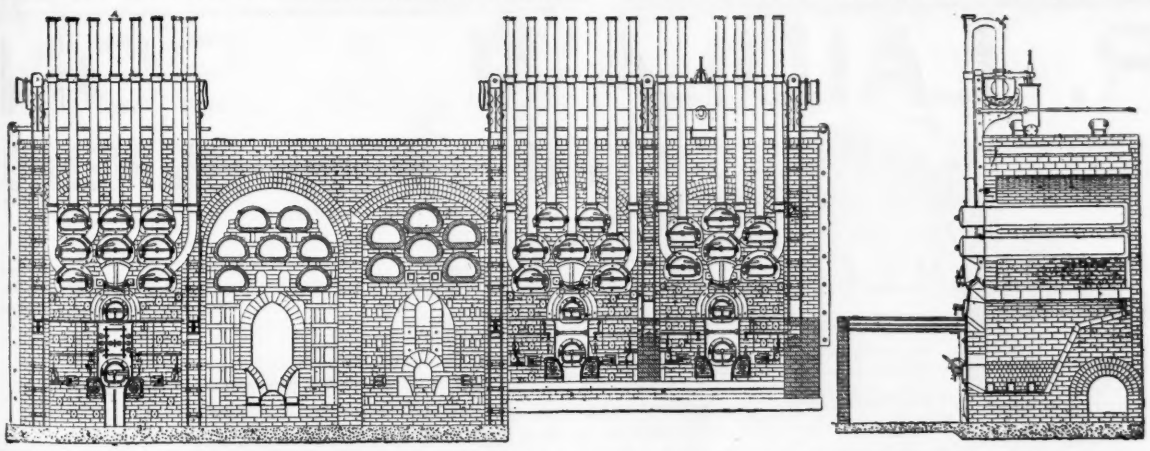
Analysis: 12,600 Feet of 19-Candle Gas per Ton.

Value in Pounds of Sperm, 820·80.

VERY FREE FROM IMPURITIES.

TELEGRAMS: "ATLAS, SHEFFIELD."

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE POSITIVELY UNRIVALLED IN PRODUCTIVE CAPACITY, DURABILITY, AND SIMPLICITY OF MANAGEMENT. RETORTS OF ORDINARY DIMENSIONS CARBONIZING FROM 18 TO 24 CWT. OF ENGLISH AND 21 TO 28 CWT. OF SCOTCH COAL PER 24 HOURS, DEPENDING UPON THE NATURE OF THE COAL, AND PRODUCING UP TO FULLY 13,000 CUBIC FEET PER MOUTHPIECE IN THE SAME TIME, AND WITH THE SMALLEST EXPENDITURE OF FUEL ATTAINABLE, AND RETURNING IN PROFIT THE ENTIRE COST OF ERECTION WITHIN TWELVE TO EIGHTEEN MONTHS; AND THUS REDUCING TO INSIGNIFICANCE THE INCREASED COST OF THESE SETTINGS OVER THE COMMON OR GENERATOR FURNACE SYSTEMS.

THESE SETTINGS ARE EXTENSIVELY ADOPTED, AND ARE ERECTED UPON THE SHALLOW AND STAGE FLOOR PLANS. THEY ARE ADAPTED TO ANY EXISTING ARRANGEMENTS, AND PERFECT SATISFACTION GUARANTEED. THE COMPOSITION OF FIRE-RESISTING AND OTHER SPECIAL FIRE-CLAY MATERIALS FURNISHED IS OF THE HIGHEST ORDER; AND THE SYSTEM AS A WHOLE, AS NOW PERFECTED, IS THE RESULT OF LONG EXPERIENCE AND CAREFUL STUDY OF THE PRINCIPLES OF GASEOUS FIRING.

Drawings and Tenders are furnished for the complete erection of Benches, including Retort and Bench Mounting of the most modern and approved description; or existing Ovens fitted up with the Patentee's arrangements.

Full Particulars may be had on application to the Patentee's Agents: **Messrs. JONAS DRAKE AND SON**, Retort Setters and General Carbonizing Engineers, Ovenden, Halifax, Yorkshire, Sole Agents for England, Wales, and Foreign Countries; **C. M. HAMILTON**, Retort Setter and Contractor, 5, Stuart Street, Shawlands, Glasgow, Agent for Scotland and Ireland; and to the Principal Agent, **R. F. HISLOP** (Son of Patentee), General Constructing and Carbonizing Engineer, Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non* TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED AND AFFORDING THE HIGHEST SATISFACTION.

The Patentee's SELF-SEALING CAPS FOR THE TOP OF ASCENSION-PIPES, and his "SPECIAL" FLUE PORT BOXES, are most important additions to his Carbonizing Plant.

SPENT LIMES NO LONGER WASTE PRODUCTS.

Under G. R. HISLOP'S Patents, all Spent Limes are effectively recovered at from one-third to one-half the cost of New Lime.

Further Information and Pamphlets from Principal Agent.

R. & A. MAIN,

GAS COOKING AND HEATING STOVES,

92, ALDERSGATE STREET, KINNING PARK,

LONDON, E.C., & GLASGOW.

GASEOUS FIRING A SPECIALTY.

Telegraphic Address: "DRAKESON, HALIFAX."

Telephone No. 43. HALIFAX EXCHANGE.

GAS ENGINEERS. RETORT SETTERS. IRONFOUNDERS.

SOLE MAKERS OF "MITTON'S" PATENT SELF -SEALING- RETORT-LID.

JONAS DRAKE & SON

SOLE AGENTS For "HISLOP'S" PATENT REGENERATIVE — FURNACES. — FOR ENGLAND, WALES & ABROAD.

OVENDEN, HALIFAX.

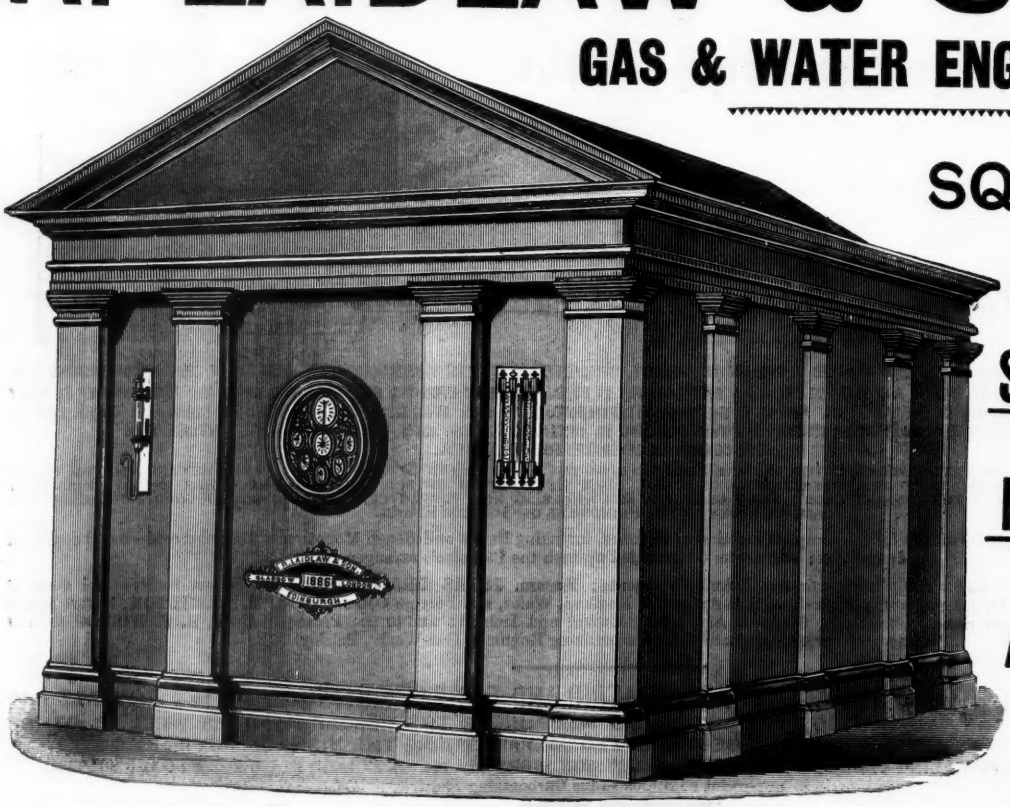
CONTRACTORS. FURNACE BUILDERS. &c. &c.

SOLE MAKERS OF "SETTLE'S" PATENT COMBINED SEAL-REGULATING FLUSH-VALVE.

LONDON OFFICE; 60. QUEEN VICTORIA ST. E.C.

R. LAIDLAW & SON

GAS & WATER ENGINEERS.



SQUARE (OR ROUND) STATION METERS ALL SIZES.

SIMON SQUARE WORKS, EDINBURGH. | ALLIANCE FOUNDRY, GLASGOW. | 6, LITTLE BUSH LANE, LONDON.

ALEX. C. HUMPHREYS, M.Inst.C.E. A. G. GLASGOW, M.E.

MESSRS. HUMPHREYS & GLASGOW

Have constructed their EUROPEAN type of

CARBURETTED WATER-GAS PLANT

At the following Gas-Works:—

Copenhagen	700,000 Cub. Ft.	Liverpool	2,500,000 Cub. Ft.
Belfast	1,700,000 ,,	Brighton	1,250,000 ,,
Glasgow	300,000 ,,	Bath	1,000,000 ,,
Brussels	700,000 ,,	Preston	1,500,000 ,,
Santiago	400,000 ,,	Southport	750,000 ,,
Swansea	700,000 ,,	New York	1,000,000 ,,
Tottenham	600,000 ,,	Newburgh, N.Y.	350,000 ,,

And have now under Contract:—

Belfast (Second Contract)	3,500,000 Cub. Ft.	Manchester	3,000,000 Cub. Ft
Edinburgh	2,000,000 ,,	Brussels (Second Contract)	700,000 ,,
Tottenham (Second Contract)	750,000 ,,	St. Joseph, Mo.	750,000 ,,
Winchester	200,000 ,,	Holyoke, Mass.	500,000 ,,
Hoylake	125,000 ,,	Shanghai	225,000 ,,

In addition to which the previous Installations of The Gaslight and Coke Company under this System have a total capacity of 10,000,000 cubic feet per diem.

9, Victoria Street, London, S.W. Telegrams: "EPISTOLARY, LONDON." *United States Office, 64, Broadway, New York.*

THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

MIDLAND DISTRICT OFFICE: 22, TEMPLE ST., BIRMINGHAM—SOLE AGENT: A. C. SCRIVENER.
TELEGRAPHIC ADDRESS: "WIGAN BIRMINGHAM." TELEPHONE No. 200.
LONDON DISTRICT OFFICE: 6, STRAND, LONDON—C. PARKER & SON, SOLE AGENTS.
TELEGRAPHIC ADDRESS: "PARKER LONDON."

Special Notice

TO GAS COMPANIES AND DISTRICT COUNCILS, ARCHITECTS, BUILDERS, AND CONTRACTORS.

The CHAMPION INCANDESCENT GAS-BURNER.

BEST LIGHT AT LOWEST COST.

We beg to advise our numerous friends and customers that the Champion Incandescent Gas-Burner still holds the field, and that our sales are increasing daily, notwithstanding the threats of our competitors.

Mantles are sold in any quantity without restriction for use of particular kinds, and are very durable.

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Several large Show-Rooms will shortly be opened in different Districts. All Agents and Buyers are fully indemnified against Law Proceedings. A few more Agents wanted in several Districts.

BOWENS' Ltd. Successors,

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MANUFACTURERS OF

BEST FIRE-BRICKS; INCLINED, HORIZONTAL, and SECTIONAL RETORTS; LUMPS, TILES, &c., of every description.

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WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,

WORTLEY FIRE-CLAY WORKS,

Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT

MACHINE-MADE GAS-RETORTS.

THE THAMES BANK IRON CO.

UPPER GROUND STREET, LONDON, S.E.,

SUPPLY FROM STOCK

CAST-IRON RETORTS.

AND ALL KINDS OF GAS-WORKS APPARATUS.

SOCKET-PIPES FOR GAS OR WATER PURPOSES.

FLANGE PIPES FOR STEAM.

Sole Manufacturers of LYON'S 'PATENT' GAS MAIN SYPHONS.

AGENTS FOR

ATTERTON'S PATENT APPARATUS for CHARGING RETORTS.

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Patent Automatic Machinery

FOR

DRAWING AND CHARGING GAS-RETORTS.

Full Particulars may be obtained from the Sole Makers,

SIR WILLIAM ARROL & CO., Limited,

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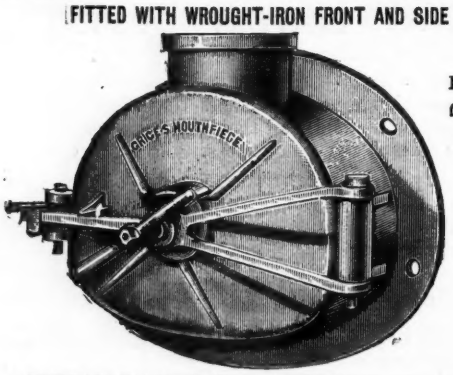
[See Illustrated Advertisement, April 7, p. 736.]

GRICE'S SELF-SEALING MOUTHPIECE,

FITTED WITH WROUGHT-IRON FRONT AND SIDE LEVERS.



Patterns for Oval, ∩, and Rounds, or all sized Retorts.

Catalogue and Price on application.

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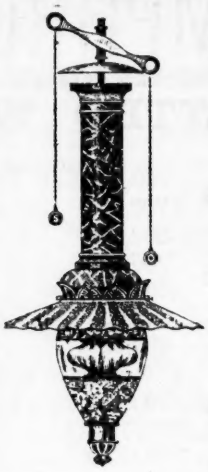
The Climax of Regenerative Gas Lighting!!



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"VERTMARCHE"

A 280-CANDLE POWER PLAIN IRON LAMP,

CLASS A— 55/-

LIGHT for LIGHT

less than half the price of any other Regenerative Lamp.

Manufactured in England.

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PARTICULARS AND PRICES FREE. AGENTS WANTED.

GAS & WATER PIPES

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CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

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NEAR BIRMINGHAM

(Established 50 Years),

PATENTEES

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OF

IMPROVED GASHOLDERS AND BOILERS

and Manufacturers of every description of

Gas Apparatus,

Cast and Wrought Iron Tanks, Purifiers, Condensers, Scrubbers, Retort-Lids, Cross-Bars and Screws, Wrought-Iron Boilers for Stationary, Portable, and Marine Engines, Sugar Pans, Coolers, Clarifiers, Punts, Boats, Bridges, Girders, Roofs, Cisterns, Oil-Tanks, Melting-Pots, Crucibles, Salt-Pans, Arch and Range Boilers, and every description of General Ironwork.

Drawings, Specifications, and Estimates supplied.

HARPER & MOORES,
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MANUFACTURERS OF

BEST FIRE-BRICKS, GAS-RETORTS,

LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.

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MANUFACTURERS OF GLASSHOUSE POTS AND CRUCIBLES OF EVERY KIND.

ESTABLISHED 1836.

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INCORPORATED IN

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MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.

Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

GODDARD, MASSEY, & WARNER'S

IMPROVED

Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICES APPLY TO

GODDARD, MASSEY, & WARNER,
ENGINEERS,
NOTTINGHAM.

The Apparatus has been supplied to the following Firms—

BURT BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
CHANCE BROTHERS, OLDBURY (FOUR APPARATUS).
RUNCORN SOAP & ALKALI CO., Limited, RUNCORN.
NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited, SHADWELL.
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And to the following Gas Companies and Corporations—

ILKESTON.
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PELOUZE & AUDOUIN'S
PATENT MECHANICAL CONDENSER.

Over 292,000,000 Cubic Feet of Gas per Day is passing through about 550 of these Machines.

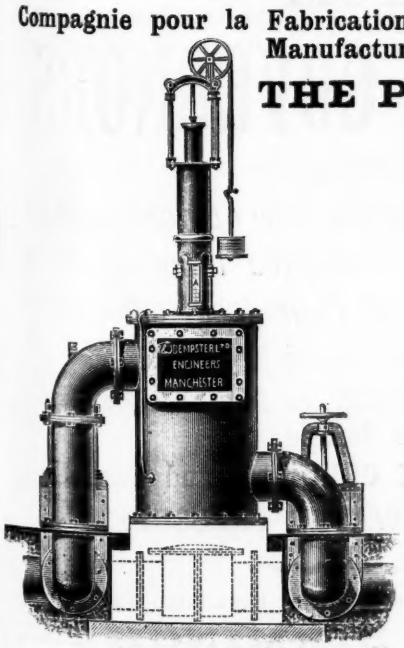
Messrs. R. & J. DEMPSTER, Limited,

HAVE PLEASURE IN ANNOUNCING THAT THEY HAVE MADE ARRANGEMENTS WITH THE

Compagnie pour la Fabrication des Compteurs et Materiel d'Usines a Gaz, of Paris, to Manufacture and Sell in this Country and the Colonies,

THE PELOUZE & AUDOUIN CONDENSER,

According to P. AUDOUIN'S LATEST PATENTS.



FRONT ELEVATION.

This Apparatus is in very general use in most of the Gas-Works on the Continent and in America; over **550** being in use in different parts of the World for condensing and arresting all Tar Particles and Vapours from the Gases from Coal, Oil, and Wood.

The large number in use is sufficient proof of its utility. By the almost complete elimination of Tar, which is effected to the extent of 99·7 per cent., it facilitates Purification in the Purifiers, by preventing the clogging or obstruction of the Purifying Materials, which, in consequence, last much longer; thus effecting a Saving both in Materials and Labour.

So effective is this Apparatus that a piece of white paper placed over a Test-Tap on the Inlet of the Machine is immediately covered with Tar, whilst on the Outlet the white paper remains perfectly clean.

The Machines are made in the following sizes, for Works producing per 24 hours—

	Cubic Feet.		Cubic Feet.
0	35,000	5	500,000
1	70,000	6	700,000
2	140,000	7	1,240,000
3	210,000	8	1,750,000
4	350,000	For larger Makes, two Machines are recommended.	

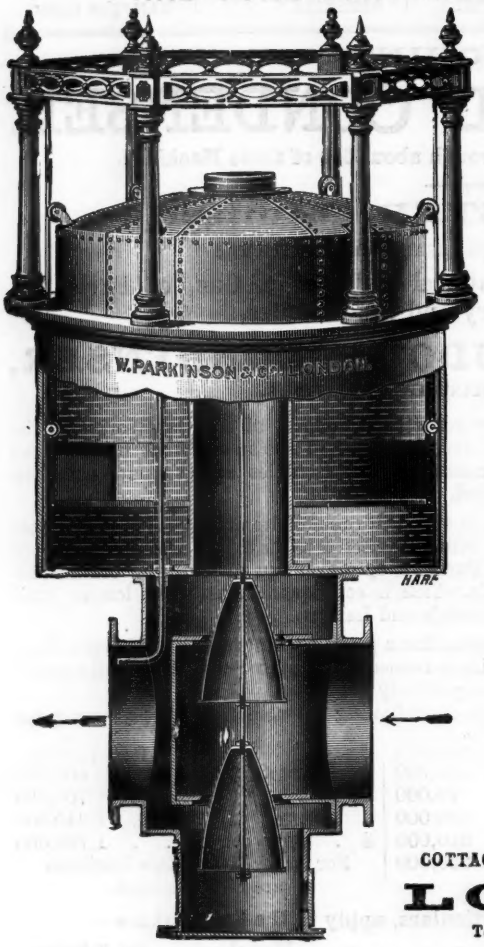
For Prices and further Particulars, apply to the Sole Makers—

Telegraphic Address: "SCRUBBER, MANCHESTER." **R. & J. Dempster, Ld., Gas Plant Works, Newton Heath, Manchester.** Nat. Telephone Nos. 2296 & 54.

W. PARKINSON & CO.

SQUARE STATION METERS.

All the Meters (which number 14) at the Beckton Station of THE GASLIGHT AND COKE COMPANY have been erected by the above Firm.



PARKINSON'S PATENT EQUILIBRIUM GOVERNORS.

A very large number are now at work; and all Engineers who have adopted them speak in unqualified terms of their great efficiency.

COUNTERBALANCE or AIR VESSEL, as desired.
TWO, FOUR, or SIX COLUMNS and GIRDERS.
WEIGHTS or WATER PRESSURE.

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Telegraphic Address: "INDEX."

BELL BARN ROAD WORKS,
BIRMINGHAM.
Telegraphic Address: "GAS-METERS."

[See also Advt. p. 850.

LONDON: Printed by WALTER KING (at the Office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, April 21, 1896.